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THE MAGAZINE OF TRANSFORMATION IN ELECTRONIC AND OPTICAL TECHNOLOGY

Import/export COMPLIANCE

Failure to comply with import/export regulations could cost defense electronics suppliers millions of dollars in fines or even criminal charges. **PAGE 14**

Soldier systems

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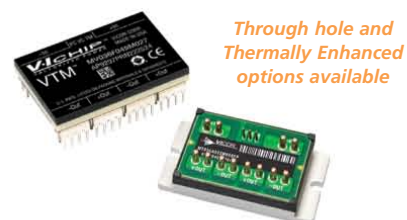
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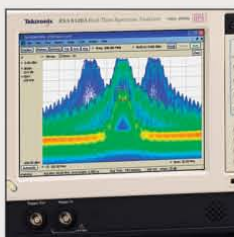
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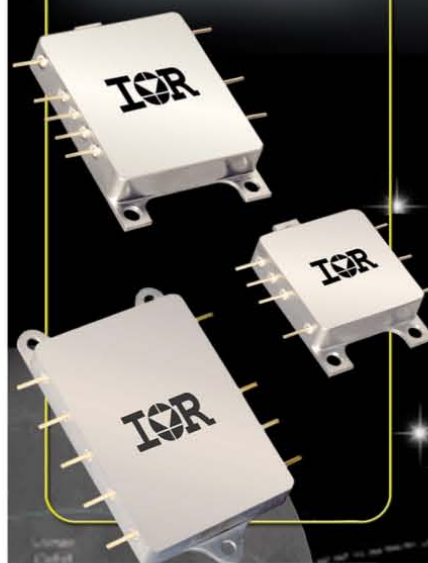
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Import/export regulations

Eternal vigilance is the only way for defense electronics suppliers to approach import/export compliance because one violation could result in millions of dollars in fines or even criminal charges. Meanwhile, the U.S. government is planning to streamline compliance regulation and enforcement under one department. **Page 14**

Soldier systems: achieving the mission and getting home alive



By **JOHN KELLER**
EDITOR IN CHIEF

Soldier systems—wearable computers, networked sensors, pocket-sized navigation and guidance systems, and the like—have been on my mind lately. I often wonder what the American infantryman about to storm the beaches at Normandy would think of today's soldiers on patrol in Iraq and Afghanistan.

On the Normandy beaches, the average soldier carried his rifle, ammunition, water, food, rudimentary first-aid gear, helmet, extra socks, and really not a lot else

then get back home alive.

One of the primary goals of those specifying and designing soldier systems technology is to keep these critical choices to a minimum, or more to the point, help soldiers make choices of ammunition, water, food, AND sensors, communications, and computers, rather than the other way around, which is the topic of this month's Technology Focus on page 18.

Soldier systems today, however, are not just about piling on capability to the warfighter in the field. Soldier technology also is about helping infantrymen fight smarter, and to give them new ways not only to help them fight, but also to survive and thrive long after returning to their homes and families.

Soldiers in the field take a beating, from the elements, from stress and fatigue, and, of course, from bullets and explosives during battle. Explosions—especially those from improvised explosive devices (IEDs) planted along roadsides, have the potential to create far more serious injuries than meets the eye.

A soldier might get caught in an IED explosion, and simply get up and dust himself off after waiting for the stars and spider webs to clear from his head. Yet, head injuries from concussive forces like roadside bombs can cause lingering injuries that might take days or weeks to make themselves known.

Now picture this: What if a soldier had a motion sensor embedded in his helmet able to measure the concussive force of an explosion on the soldier wearing it? What if a little red LED in this helmet sensor started flashing if the force of the explosion were more than a human being should be able to withstand safely over the long term?

No need to speculate anymore; that technology's here, and is being deployed in the field. It's just one of the aspects of soldier systems that are making the modern soldier ever-more effective, deadly, and survivable. ●

SENIOR VICE PRESIDENT, GROUP PUBLISHER
CHRISTINE SHAW
TEL (603) 891-9178 • cshaw@pennwell.com

ASSOCIATE PUBLISHER
DOUGLAS M. MAILAT
TEL (603) 891-9137 • dougm@pennwell.com

EDITOR-IN-CHIEF JOHN KELLER
TEL (603) 891-9117 • FAX (603) 891-9146
jkeller@pennwell.com

EXECUTIVE EDITOR JOHN McHALE
TEL (603) 891-9119 • FAX (603) 891-9146
jmchale@pennwell.com

SENIOR EDITOR COURTNEY E. HOWARD
TEL/FAX (509) 587-3344 • courtney@pennwell.com

CONTRIBUTING EDITOR
WESTERN BUREAU J. R. WILSON
TEL (702) 434-3903 • FAX (702) 920-8068
jrwilson@pennwell.com

PRESENTATION EDITOR CINDY CHAMBERLIN
PRODUCTION DIRECTOR SHEILA WARD

SENIOR ILLUSTRATOR CHRIS HIPPE
AUDIENCE DEVELOPMENT MANAGER
JAYNE SEARS-RENFER
TEL (603) 891-9416 • jaynesr@pennwell.com

AD SERVICES MANAGER STEVE ARCHER
TEL (918) 831-9473 • admaterial@pennwell.com



EDITORIAL OFFICES
PENNWELL CORPORATION,
MILITARY & AEROSPACE ELECTRONICS
98 Spit Brook Road LL-1, Nashua, NH 03062-5737
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CORPORATE OFFICERS
CHAIRMAN FRANK T. LAUINGER
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NEWS

Safe, efficient aircraft approaches in heavy traffic are aim of NASA air traffic control research

By **JOHN KELLER**

MOUNTAIN VIEW, Calif.—Air traffic management experts at the NASA Ames Research Center in Mountain View, Calif., are working with academia to find the most efficient avionics designs that enable passenger aircraft to descend safely and efficiently to their destination airports through heavy traffic and with minimal fuel burn.

NASA Ames researchers are looking to air traffic control experts at the University of California at Santa Cruz to incorporate 3D path arrival management (3D-PAM) capability into en route descent advisor (EDA) software for potential use in

the Next Generation Air Transportation System (NextGen).

3D PAM involves three-dimensional



NASA researchers are looking for ways to help commercial aircraft save time and fuel as they make safe approaches to destination airports.

flight paths that air traffic control can use to stretch or shorten aircraft approaches to airports to manage aircraft traffic most efficiently—especially during heavy congestion, such as during weekend or holiday periods.

These sets of 3D paths contain a nominal path that an airplane would fly without any interaction from air traffic controllers, as well as additional path options to space airplanes

Continued on page 7

BAE Systems, Allen-Vanguard build helmet-mounted sensors to measure IED blast on Army soldiers

By **JOHN KELLER**

NATICK, Mass.—U.S. Army researchers are asking two defense contractors to design and build advanced helmet-mounted sensors that measure blast trauma to soldiers inflicted by roadside bombs. These sensors compile blast data to help save troops from battlefield head injuries by improving helmet designs, other protective clothing, and other ways for the Army to prevent and mitigate blast effects on soldiers from improvised explosive devices (IEDs).

The Army is awarding a \$17 million contracts to the BAE Systems Security & Survivability segment in Phoenix, and to Allen-Vanguard Corp. in Ashburn, Va., to design and manufacture the Generation II Helmet Sensor to record concussive forces, such as helmet acceleration and blast pressure.

The sensors will be mounted beneath the pad in the crown of the Advanced Combat Helmet.

Data captured by the Generation II Helmet Sensor not only will help define the threat of head injuries from IEDs for developers of soldier protective equipment, but also to develop a detailed model of how the helmets and helmet pads distribute and cushion external pressures on the helmet, Army officials say. Awarding the contracts are researchers at the Army Research Development & Engineering Command in Natick, Mass.

The Generation II sensors add wireless capability to download data without plugging the sensor into a USB port, as is the case with the Generation I Helmet Sensor. The second-generation sensors also

Continued on page 7

IN BRIEF

Boeing to build eight C-17 military transport aircraft under \$1.5 billion contract

U.S. Air Force leaders ordered eight Boeing C-17 Globemaster III rapid strategic airlift aircraft designed to operate from main operating bases or forward operating bases with short or unimproved runways. Boeing will build the large cargo aircraft at its Global Mobility Systems segment in Long Beach, Calif., under terms of a \$1.5 billion contract. Awarding the contract were officials of the Air Force 516th Aeronautical Systems Group at Wright-Patterson Air Force Base in Dayton, Ohio, which is responsible for modernization, development, test, production, deployment, and sustainment of the C-17 aircraft, its avionics, and its F117 engines, which are military version of the Pratt & Whitney PW2040 engines that power the Boeing 757 commercial jetliner. The C-17 is designed to operate from paved and unpaved runways as short as 3,500 feet and as narrow as 90 feet. Its thrust reversers can back the aircraft and reverse direction on narrow taxiways. The aircraft is large and powerful enough to carry the 70-ton M1 Abrams main battle tank. In addition to the United States, its operators include the military forces of Australia, Canada, India, NATO, Qatar, United Arab Emirates, and the United Kingdom.

Boeing F-15 Silent Eagle demonstrator makes first flight

Boeing's Silent Eagle flight demonstrator aircraft F-15E1 completed its first flight from Lambert St. Louis International Airport. During the 80-minute flight, F-15E1 opened and closed its left-side Conformal Weapons Bay, which contained an AIM-120 Instrumented Test Vehicle (ITV) missile. The ITV was not launched. The Silent Eagle was developed in response to international user requirements for a cost-effective, high-performance fighter aircraft to defend against future threats, Boeing officials say. The F-15SE offers unique aerodynamic, avionics, and radar cross-section reduction features that provide the user with maximum flexibility to dominate the ever-changing advanced threat environment. The aircraft's Conformal Weapons Bays can carry a variety of air-to-air missiles and air-to-ground weapons.

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NEWS

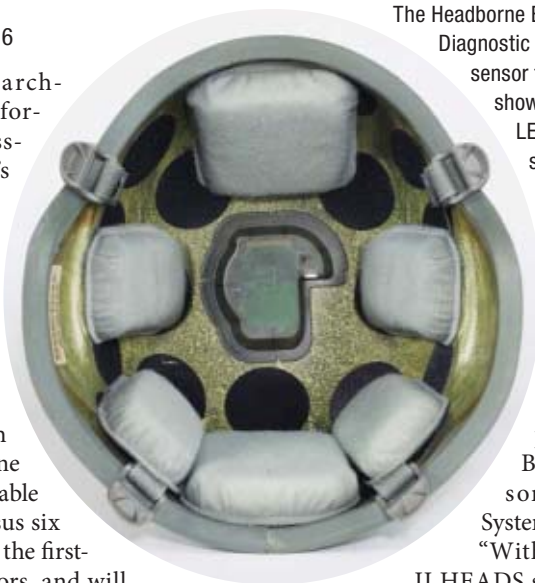
BAE from page 6

will help researchers retrieve information wirelessly on the sensor's power consumption, remaining memory, and overall functionality.

The Generation II sensors are smaller in size, weigh less, and have one year of rechargeable battery life, versus six months now for the first-generation sensors, and will retain USB capability for downloads and recharging.

BAE Systems officials call their company's helmet-mounted sensor the Headborne Energy Analysis and Diagnostic Systems—HEADS, for short—to help the infantry soldiers mitigate threats of traumatic brain injuries (TBI).


"Diagnosing mild to moderate combat-related TBIs can be challenging. For example, following an explosion from a roadside bomb, soldiers will sometimes continue with their mission, unaware that the concussion from the blast may have lingering



The Headborne Energy Analysis and Diagnostic Systems (HEADS) sensor from BAE Systems, shown at left, has an LED indicator that shows when soldiers may have suffered serious head injuries in blasts.

effects," says Joe Coltman, vice president of the BAE Systems Personnel Protection Systems business.

"With the Generation II HEADS sensor, even if the injury isn't obvious, once the sensor collects data indicating a blast has exceeded a certain threshold, a LED light located on the sensor and will be activated and begin blinking, signifying to soldiers that they may have sustained a concussion warranting immediate attention," Coltman explains.

For additional information, visit BAE Systems Security & Survivability online at www.baesystems.com, Allen-Vanguard at www.allenvanguard.com, or the U.S. Army PEO Soldier at www.peosoldier.army.mil. 

Air traffic control from page 6

and provide timing control to accommodate necessary delays due to heavy air traffic congestion.

NASA Ames is awarding a \$42,013 contract to UC Santa Cruz to incorporate 3D-PAM capability into existing EDA software to generate conflict-free, time-based metering solutions for maximum arrival throughput and efficiency under heavy-traffic conditions.


UC Santa Cruz experts will help develop and test air traffic control automation technology to enable fuel-efficient arrival operations during all traffic conditions, particularly during busy air traffic conditions where demand exceeds available airspace or airport capacity.

EDA software helps air traffic controllers working in FAA en route air traffic control facilities to manage continuous aircraft descents at low engine power. The

enhancements envisioned for UC Santa Cruz are expected to reduce controller and pilot workload by keeping air traffic control communications to a minimum during aircraft arrivals.

EDA generates speed, altitude, and route advisories to enable airplanes to fly arrival trajectories that minimize fuel burn and environmental emissions, while keeping them safely separated from other traffic and in compliance with capacity constraints.

Over the next 15 years, air traffic in the United States is expected to double, and far exceed current capability to fly aircraft safely, which is among the reasons for developing NextGen technology, such as EDA and 3D-PAM.

For more information, contact the UC Santa Cruz Office of Sponsored Projects online at <http://research.ucsc.edu>, or the NASA Ames Research Center at www.nasa.gov/centers/ames. 

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» NEWS

Navy demonstrates shipboard networking to bridge fleet to future CANES communications for surface warships

By **JOHN KELLER**

SAN DIEGO—U.S. Navy leaders are using the aircraft carrier USS Abraham Lincoln (CVN 72) and its escort ships as a demonstration laboratory of new open-systems shipboard networking technology, and to create a bridge to a new generation of high-performance military data networking aboard the Navy's fleet of warships.

The Lincoln carrier battle group went to sea for tests last January to demonstrate new surface ship networking capability as part of the Integrated Ship Network System (ISNS). This technology ultimately will lead the way to the Navy's newest data networking initiative called Consolidated Afloat Networks and Enterprise Services (CANES).



The aircraft carrier USS Abraham Lincoln, shown above, and its escorts are floating laboratories for the next generations of Navy shipboard networking.

The challenge Navy officials confront in the ISNS program, as well as in their approach to CANES, is to integrate contemporary open-systems networking in the Navy surface fleet without disrupting the many existing networks on which the Navy relies, explains Dan Phelan, program manager for the Lockheed Martin Technology Center-West in San Diego.

The sea trials aboard the Lincoln battle group last January represented an ISNS early adopters program—a risk-mitigation effort the navy took to con-

solidate legacy networks aboard ships. "They design a ship to last 30 to 40 years, but IT [information technology] is added on top of that," Phelan explains. "Each of those networks was brought on individually, and carriers have about 50 networks."

The aim is to move to a common infrastructure and a common interface to take advantage of the latest data networking technology, such as Microsoft, Sun Solaris, and Linux, yet creating a structure independent of proprietary vendor technology that can be upgraded frequently and easily.



"We don't want to be tied to only one architecture or technology description," Phelan explains. "The Navy has to modernize while not breaking these legacy networks." The ISNS program has yielded a common networking infrastructure with modern processing, data storage, and modern software to host the Navy's legacy networks. The Navy also wants to eliminate the use of aging Microsoft Windows NT-based applications aboard ship.

Leading the ISNS program is the Space and Naval Warfare Systems Command in San Diego, with lead contractor Lockheed Martin Maritime Systems segment in Eagan, Minn. Last March the Lockheed Martin Maritime Systems & Sensors (MS2) Tactical Systems in San Diego won a \$15 million contract, while the Northrop Grumman Information Systems segment in Reston, Va., won a \$17.4 million contract to provide the CANES common computing environment (CCE). The Navy CANES program will have a down-select to one lead contractor in 2011.

CANES, which should be operational by 2014, will take the ISNS project one giant step further by consolidating all Navy shipboard networks. The challenges and risks of achieving that, however, are substantial. "We have to go step-by-step," Phelan says. "They proved they can do something like that on the Lincoln battle group, and this will mitigate the risk for us."

Right now the path forward on Navy shipboard networking is still ISNS, which is the program of record, Phelan says. Plans are in the works, however, to make a seamless transition to CANES. ISNS Increment 1 is also known as CANES Increment Zero, while ISNS Increment 2 will be known as CANES Increment 1, Phelan says. ●

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DOD researchers look to Lockheed Martin and Raytheon to develop high-power laser weapons technology

By **JOHN KELLER**

HUNTSVILLE, Ala.—U.S. military laser weapons researchers are asking two major U.S. defense contractors to develop electrically driven high-power laser technology for future generations of laser weapon systems. The contracts call for Lockheed Martin and Raytheon to capitalize on high-energy laser technology developed during the past five years to demonstrate 25-kilowatt military lasers, and design ruggedized military laser weapon subsystems at powers as strong as 100 kilowatts.

The U.S. Army Space Missile Defense Command in Huntsville, Ala., is awarding a \$14.7 million contract to the Lockheed Martin Mission Systems & Sensors (MS2) Integrated Defense Technologies segment

in Bothell, Wash., and a \$9.1 million contract to the Raytheon Co. Space and Airborne Systems segment in El Segundo, Calif., for the Robust Electric Laser Initiative (RELI) program.

Army Space Missile Defense Command is awarding the contracts also on behalf of the DOD High Energy Laser Joint Technology Office (HEL JTO), the Air Force Research Laboratory (AFRL), and the Office of Naval Research (ONR).

DOD researchers want Lockheed Martin and Raytheon to develop an efficient high-power electrically driven laser system suitable for a scalable, ruggedized military laser module packaged for ground-, sea-, or air based military applications. Ultimately, experts at the two companies will build

laboratory-grade lasers with performance traceable to weapon system applications.

DOD researchers want the companies to develop high-power, weapons-grade lasers with better than 30 percent efficiency, with beams near diffraction limited quality, with power greater than 25 kilowatts, with run times that meet military mission requirements.

Lockheed Martin and Raytheon will demonstrate and test the lasers they develop at the DOD High-Energy Laser System Test Facility at White Sands Missile Range, N.M.

For more information, visit Lockheed Martin Mission Systems & Sensors online at www.lockheedmartin.com/ms2, or Raytheon Space and Airborne Systems at www.raytheon.com.

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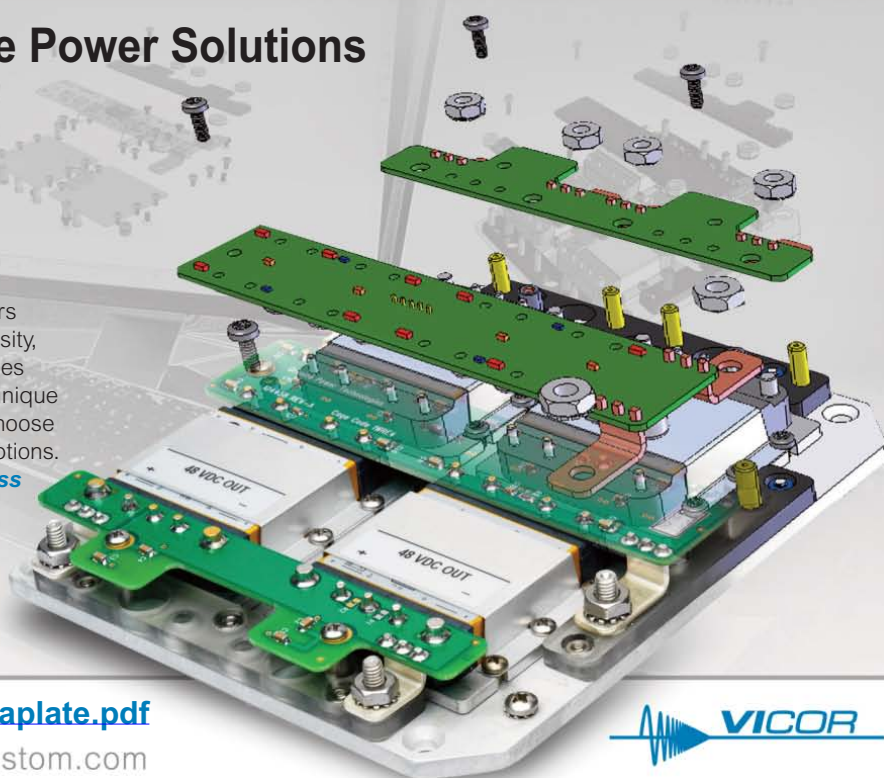
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» NEWS

Air Force looks for machine autonomy to enable UAVs and piloted aircraft to work and play well together

By **JOHN KELLER**

WRIGHT-PATTERSON AFB, Ohio—U.S. Air Force researchers are asking industry to develop autonomous control technologies that will enable unmanned aerial vehicles (UAVs) to operate together with piloted aircraft in congested airport terminal areas, and to achieve what the Air Force calls “same base, same time, same tempo” operations.

Scientists at the Air Force Research Laboratory at Wright-Patterson Air Force Base in Ohio, have released a broad agency announcement (BAA-10-05-PKV) for the Autonomous Control of UAS Ground Operations in the Terminal Area program. The goal of the program is to enable UAVs to operate with manned aircraft by equipping unmanned aerial systems (UAS) to act autonomously and react like a manned aircraft so they can navigate the terminal area alongside manned commercial and general-aviation aircraft. The emphasis of this program is on ground operations, according to U.S. Air Force officials.

The Air Force primarily is interested in five technology challenges for this program: communication-based response; navigation and collision avoidance; intent of other aircraft; integrity management; and sensors.

Air Force researchers chose Barron Associates Inc. in Charlottesville, Va., in April to develop autonomous sense-and-avoid (SAA) collision-avoidance technology for UAS to prevent them from hitting or interfering with other manned and unmanned aircraft as part of the Multi-Vehicle Unmanned Aircraft Systems Sense And Avoid (MUSAA) program. Barron Associates specialists in intelligent and adaptive technologies now are finding ways to enable UAVs to perform the same essential functions as a human aircraft pilot: to see and avoid other aircraft.

The communication-based response portion of the Autonomous Control of

UAS Ground Operations in the Terminal Area program involves the sensitive nature of how quickly ground controllers can communicate with aircraft in the terminal and ensure the aircraft respond and act quickly on controller directives.



The Air Force is trying to develop machine-automation technology to enable unmanned aircraft to operate safely alongside each other and with piloted commercial aircraft in congested airport terminal areas.

UAS should be able to receive, acknowledge, and perform all commands from air traffic control (ATC) as quickly as manned aircraft—and obtain clarification in the case of unclear instructions or if the UAS believes controllers have given an incorrect command. Autonomous response to ATC is a potential solution, Air Force officials say.

Navigation and collision avoidance involves the ability of UAVs to complete their assigned tasks autonomously and in ways familiar to human controllers and pilots after receiving commands from ATC. This should not require extensive air field surveys or changes to the air field infrastructure.

Intent of other aircraft involves the ability of UAS to determine the intent of other aircraft based on data from on-board sensors and an understanding of typical airfield operations. By logging

ATC communications, for example, the UAS could understand the status of nearby aircraft, which could enable the UAS to be more proactive than reactive in its behavior.

Integrity management involves UAS ability to evaluate the integrity of systems and data to deal effectively with the complex and critical nature of the terminal area environment.

The sensors portion of the program calls for winning companies to investigate appropriate sensor suites, with an emphasis on sensors already in existence on typical UAS, as well as those being considered for functions such as sense and avoid.

The Air Force plans to award two contracts for the first phase of the Autonomous Control of UAS Ground Operations in the Terminal Area program, each worth about \$500,000.

After the initial evaluation phase, the Air Force will choose one contractor for the approximately \$4 million and remaining three years of work.

Phase I will design an architecture to enable UAS to operate with manned aircraft in the terminal area. The winning contractor will implement and test this architecture in Phase II, and undertake algorithm development, simulation, and ground testing, with a final demonstration that takes a UAS from its parking area to the runway where the “clear for takeoff” command is given.

Other aircraft, both on the ground and in the terminal airspace, may be real or simulated. Responses to real-world challenges such as changes in route, obstacles, incorrect or conflicting ATC commands, and misunderstood commands also will be demonstrated.

The first contracts are expected by the end of September.

More information is available online at <https://www.fbo.gov/spg/USAF/AFMC/AFRLWRS/BAA-10-05-PKV/listing.html>. ●

MITRE asks defense industry to help formulate standard for software APIs in cryptographic applications

By **JOHN KELLER**

BEDFORD, Mass.—Cryptography experts at the MITRE Corp. in Bedford, Mass., are urging the aerospace and defense industry to participate in formulating a cryptographic application programming interface (API) standard for aerospace, defense, and other high-assurance applications.

MITRE has submitted an Internet draft based on the publicly released version 0.6 of Common Interface to Cryptographic Modules (CICM) to the Internet Engineering Task Force (IETF). The proposed CICM standard is a U.S. Air Force-sponsored cryptographic API.

CICM is the first generic cryptographic API that allows for security domain separation and provides the rich module management support necessary for high-assurance

cryptographic devices. The newest version of CICM is programming language agnostic and specifies a set of cryptographic primitives, including encryption, signature generation, hashing, bypass, and keystream generation.

CICM also offers extensive support for key management, including key agreement protocols in addition to the generation, protection, and destruction of key material. The specification has attracted significant interest within the DOD community and internationally, MITRE officials say.

CICM's ability to enable software to be decoupled from the provider of cryptographic services on a system enables organizations to deliver security-critical software more rapidly, with reduced risk, and

at reduced cost, than is possible today.

MITRE experts are asking those interested to participate in the standards process by subscribing to the CICM mailing list. Those participating can join the discussion and help move the standard through the approval process, as well as be part of building a consensus around the standard's key features.

Subscribe to the CICM standard mailing list online at <https://www.ietf.org/mailman/listinfo/cicm>. The draft CICM standard is available for download at <https://datatracker.ietf.org/doc/draft-lanz-cicm/>.

For more information, contact MITRE Corp.'s Dan Lanz by e-mail at dlanz@mitre.org, or Lev Novikov at lnovikov@mitre.org. Visit MITRE Corp. online at www.mitre.org.

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» NEWS

One-quintillion calculations per second: DARPA sets sights on extreme-scale computing

By **JOHN KELLER**

ARLINGTON, Va.—Computer scientists at the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., are asking industry for new high-performance computing technologies that could enable so-called extreme scale computing: the notion of exceeding today's peta-scale computing to achieve one quintillion (1,000,000,000,000,000,000) calculations per second.

DARPA released a broad agency announcement (DARPA-BAA-10-78) for the Omnipresent High Performance Computing (OHPC) program to help develop tomorrow's high-performance computers to meet the relentlessly increasing demands for greater performance, higher energy efficiency, ease of programmability, dependability, and security in aerospace and defense computing for military sensors, platforms, and missions.

The DARPA OHPC program is to provide new computer technologies for a


similar DARPA initiative called the Ubiquitous High Performance Computing (UHPC) program to develop new classes of high-performance computing, from embedded computing to cabinet computing, with dramatically reduced power consumption while delivering a thousand-fold increase in processing capabilities. The UHPC program, under consideration now, is to develop adaptable and hardened cyber resilient computer systems that will not require significant system expertise.

The DARPA OHPC program seeks to speed-up the UHPC initiative with new research aimed at extreme scale computing, which also is known as exascale computing, and will develop technologies will be integrated into one or more UHPC systems.

Topics of interest in the OHPC program include software that not only reduces requirements for high-performance computing, including memory and storage, but also that enables programmability to reduce the

need for users to understand complex system aspects like heterogeneous cores and memory hierarchy; hardware and software for managing component failure rate, as well as shared information and responsibility among the operating system, runtime system, and applications; scalable I/O systems that may include alternatives to file systems; self-aware system software; programming models that allow developers to express their execution goals for achieving security, dependability, power efficiency, and performance; and low-power circuits that can be used across multiple UHPC or extreme scale system designs.

Companies interested must provide final proposals by 22 Dec. 2010. DARPA officials say they expect to award several contracts. For questions or concerns, contact DARPA's William Harrod by e-mail at DARPA-BAA-10-78@darpa.mil.

More information is online at <https://www.fbo.gov/spg/ODA/DARPA/CMO/DARPA-BAA-10-78/listing.html>. 

» IN BRIEF

U.S. Navy orders more Thales minesweeping equipment

Thales Australia in Garden Island, Australia won a follow on contract from the U.S. Department of Defense to supply minesweeping equipment for the U.S. Navy's Avenger class Mine Counter Measure Vessels (MCMVs). The contract for four ship sets with the Naval Surface Warfare Center Panama City Division (NSWC PCD) includes an option for a further three ship sets, and follows several contracts for Thales minesweeping systems for the Navy. Over the past four years, Thales Australia has delivered Advanced Acoustic Generators (AAGs), Infrasonic Advanced Acoustic Generators (IAAGs), Sweep Tracker Monitor Systems (STMS), and spares and accessories for seven of the 14 Avenger class MCMVs. The AAG is a water-driven, turbine powered acoustic generator that emulates ship noise; it can be integrated with any sweep system. The IAAG is the low-frequency variant of the AAG and has also been developed by Thales Australia and Resonance Technology. The STMS is designed for deployment with the AAG and IAAG

to provide positional tracking data and to facilitate control of both manned and unmanned operations. "The AAG gives the U.S. Navy a low-maintenance, high-reliability acoustic generator," says Andrew Tatem, NSWC PCD project engineer responsible for the installation and commissioning of the acoustic sweep on the Avenger class MCMVs.

DARPA funds Raytheon BBN Technologies to advance automatic translation

Raytheon's BBN Technologies in Cambridge, Mass., won an additional \$6.14 million in funding from the Defense Advanced Research Projects Agency (DARPA) under the Multilingual Automatic Document Classification, Analysis, and Translation (MADCAT) program. The MADCAT program's goal is to create a prototype system that quickly provides accurate, relevant, distilled, actionable information to military commands and personnel. It does this by converting foreign language text images, such as road signs, flyers, photographs, and handwritten notes, into English transcripts automatically, without the use of linguists and analysts, company officials say. Ray-

theon BBN will refine a prototype translation system that can be deployed on a laptop computer by integrating optical character recognition with its translation and distillation techniques and developing novel methods to process handwritten text.

NASA awards crew robotics, vehicle equipment contracts

NASA awarded contracts to ATK Space Systems of Brigham City, Utah; Oceaneering International and Wyle Integrated Science and Engineering, both of Houston; and the University of Alabama at Birmingham for crew robotics and vehicle equipment work on avionics, active thermal control, and other systems. The combined total value of the four contracts is not to exceed \$70 million. The contracts also involve spacewalk activity equipment, spacecraft flight crew equipment, crew health and conditioning systems, spacewalk robotics equipment, environmental control and life support equipment, and ground support systems. The equipment is for use in the space shuttle, International Space Station, and other advanced development programs.

NEWS

» IN BRIEF

P-8A Poseidon completes first in-flight test of mission systems

The Boeing P-8A Poseidon aircraft T2 completed the program's first mission systems test flight in Seattle. T2 will be used to verify integrated mission systems performance during flights in Seattle and at Naval Air Station in Patuxent River, Md. During the three-hour flight, the joint Boeing and Navy test team exercised mission computing on all five operator workstations and demonstrated key systems—including acoustics, mission planning, tactical data-link, communications, electronic support measures and flight test instrumentation—for the first time. "This successful flight moves us a step closer to getting the Poseidon and its next-generation radar and sensors into the hands of the warfighter," says Chuck Dabundo, Boeing vice president and P-8 program manager. The Navy plans to purchase 117 P-8A anti-submarine warfare, anti-surface warfare, intelligence, surveillance, and reconnaissance aircraft to replace its P-3 fleet. Initial operational capability is planned for 2013.

Lockheed Martin's SMSS vehicle demonstrates autonomous performance for logistics centers

Lockheed Martin engineers demonstrated that its Squad Mission Support System (SMSS) vehicle can perform detailed logistics tasks without human control. The testing was conducted at the Lockheed Martin facility in Littleton, Colo., for military attendees. The SMSS autonomous vehicle performed autonomous operations such as: correctly following a road network; safely maneuvering through a building complex; avoiding obstacles inserted in its path, including mannequins simulating people; following a person using only optical tracking, exercising real-time obstacle avoidance; and navigating to a person who issued a "come-to-me" command. SMSS also demonstrated its ease of operability in real-time controller-to-controller hand-offs, allowing different operators to take control of the vehicle as it arrived at new locations. Operators also disengaged autonomy and went on board the vehicle to control it manually, showcasing user options in commanding the system. The

fully loaded SMSS can be sling-loaded under a UH-60L helicopter, or carried internally in a CH-47/53 helicopter.

Euro Hawk unmanned aircraft completes first flight

The Euro Hawk unmanned aircraft system (UAS), built by Northrop Grumman Corp. and EADS Defence & Security, completed its first flight. Based on the Block 20 Global Hawk, Euro Hawk will be equipped with a new signals intelligence (SIGINT) mission system developed by EADS Defence & Security, providing standoff capability to detect electronic and communications emitters. A ground station consisting of a mission control and launch and recovery elements will be provided by Northrop Grumman. EADS Defence & Security will also provide a SIGINT ground station, which will receive and analyze the data from Euro Hawk as part of an integrated system solution. Under this contract, Euro Hawk GmbH will also provide aircraft modifications, mission control and launch and recovery ground segments, flight test, and logistics support.


Mobile ad-hoc network radio system introduced by Raytheon

Raytheon Co. introduced the new Enhanced Mobile Ad-Hoc Network Radio System to provide netted communications and tactical data for coalition interoperability. Company officials demonstrated it during EuroSatory in Paris. EMARS brings together Raytheon's Enhanced Position Location Reporting System-XF-I and MicroLight DH500 handheld radio and leverages the company's MANET (mobile ad-hoc networking) technology. The tactical system automatically and continually adapts to network changes, including those in challenging urban environments. It provides a wireless, Internet Protocol capability network that implements Advanced Encryption standard encryption over an extended frequency range. "Our new EMARS system supports a broad range of time-critical missions such as air defense, command and control, and situational awareness, as well as user-defined host applications," says Brian McKeon, vice president, Raytheon Network Centric Systems Integrated Communications Systems. "It supplies twice the data rate of our earlier system to enable EMARS' enhanced multifunction capability and provides even greater efficiency in secure wireless data exchange."

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» SPECIAL REPORT

IMPORT/EXPORT

Eternal vigilance is the only way for defense electronics suppliers to approach import/export compliance since one violation could result millions of dollars in fines or even criminal charges. Meanwhile the U.S. government is planning to streamline compliance regulation and enforcement under one department.

By **JOHN McHALE**

Import/export compliance for defense suppliers is becoming almost as complicated and risky as designing defense systems themselves. Companies must comply with a variety of import/export regulations such as the International Traffic in Arms Regulations—better known as ITAR and regulated by the U.S. Department of State—and the EAR or Export Administration Regulations, managed by the Department of Commerce. For example, companies that develop electronics listed on the U.S. Munitions List must obtain a license from the State Department before exporting. Failure to comply with these regulations could result in business-crippling fines and jail time for individuals who purposely violate them.

“Fines for ITAR violations in recent years have ranged from several hundred thousand to ITT Corp.’s \$100 million fine” in 2007, says Kay Georgi, an import/export compliance attorney and partner at the law firm of Arent Fox LLP in Washington. “Willful violations can be penalized by criminal fines, debarment—both of the export and government contracting varieties—and jail time for individuals.” The biggest case right now in the news involves BAE Systems, fined \$400 million by the State Department for violations of the Foreign Corrupt Practices Act, says Lizbeth Rodriguez, OF counsel attorney at Holland & Hart LLP in Denver, Colo.

BAE Systems and a \$400 million fine

According to a U.S. Department of Justice announcement, BAE Systems plc (BAES) pled guilty in U.S. District Court in Washington “to conspiring to defraud the U.S. by impairing and impeding its lawful functions, to make false statements about its Foreign Corrupt

Practices Act (FCPA) compliance program, and to violate the Arms Export Control Act (AECA) ITAR. BAES was sentenced to pay a \$400 million criminal fine.” It should be noted that none of the criminal conduct described in the plea involved the actions of BAE Systems Inc., a U.S. subsidiary of BAE Systems headquartered in Rockville, Md. Essentially BAE Systems violated the anti-bribery provisions of the FCPA and other anti-bribery regulations, according to the Justice Department release. “According to court documents, the gain to BAES from the various false statements and failures to make required disclosures to the U.S. government was more than \$200 million.”

According to the Justice Department release “BAES made a series of substantial payments to shell companies and third party intermediaries that were not subjected to the degree of scrutiny and review to which BAES told the U.S. government the payments would be subjected. BAES admitted it regularly retained what it referred to as ‘marketing advisors’ to assist in securing sales of defense items without scrutinizing those relationships.

“BAES admitted that it established one company in the British Virgin Islands (BVI) to conceal its marketing advisor relationships,



REGULATIONS:

comply or watch your business die and go to jail

including who the advisor was and how much it was paid, to create obstacles for investigating authorities to penetrate the arrangements; to circumvent laws in countries that did not allow such relationships; and to assist advisors in avoiding tax liability for payments from BAES," according to the Justice Department release.

Business BAE Systems conducted in with the Kingdom of Saudi resulted in violations of its arms export licenses, as required by the AECA and ITAR, according to the Justice Department release. The AECA and ITAR prohibit the export of defense-related materials to a foreign national or a foreign nation without the required U.S. government license. As part of its guilty plea, BAE Systems has agreed to maintain a compliance program to cover all the regulations it violated and to retain an independent compliance monitor for three years to assess the company's compliance program and to make a series of reports to the company and the Justice Department, according to the Justice Department release. For more information on this case, visit www.doj.gov.

Too much enforcement?

Some company leaders believe the headline-making fines, increased number of enforcement officers, and myriad complicated compliance regulations are hampering U.S. companies in competing for foreign business. There has been a great deal of enforcement in recent years and "I'm aware that some feel that it might hamper U.S. business, but I think we don't do enough when it comes to enforcing compliance." Protecting U.S. technology is critical to national security, says Dean Young, facilities security officer at Celestica Inc. in Austin, Texas. Compliance procedures can slow the pace of business, but not complying can shut a business down completely, he notes.

The culture needs to change to doing everything one can to comply as opposed to doing everything one can to avoid it, Young says. "We're jumping through hoops to get things right so we don't end up on the front page of a newspaper as a company that has just violated our export laws."

"While it was a huge argument at the passage of the FCPA in 1977 that such a law would impair U.S. companies in their competition for business in the international arena, I would argue that

Five most common import/export compliance mistakes

Kay Georgi, partner at Arent Fox LLP, says there are five common mistakes companies make when starting out in import/export compliance.

The first is classification, she says. "The companies think the products are dual use instead of ITAR, or the products shift from dual use to ITAR. By the time they realize what they have done, they are tens if not hundreds of violations down the road."

Second is IT access, Georgi continues. "It's tough to keep appropriate controls on ITAR controlled technical data, particularly when it runs through the hands of many, many engineers and sales people. Plus IT systems for dual use

products can be accessed in ITAR proscribed countries—but not for ITAR controlled products."

The third is personnel/employee licensing, Georgi says. "While many companies understand that workers who do not have U.S. citizenship or a green card need a license to work on ITAR projects, many more out there are still not up to this fundamental basic block of ITAR compliance.

Fourth is personnel/defense services, she continues. "Many companies do a fairly good job of keeping track of ITAR controlled hardware, but find it harder to make sure their people are not providing defense services. This requires a

fairly sophisticated system to educate personnel and to check upcoming trips for export compliance issues."

The fifth is license/Technical Assistance Agreements (TAA)/Manufacturing License Agreements (MLA) compliance, Georgi says. "There's a tendency to relax once you get a license or TAA or MLA approval from the State Department. But that's the point when you need to get out and make sure your people get the agreements signed, understand the provisos, and communicate with the foreign licensee(s) to make sure they understand the key license proviso. Not to mention the multiple logging and record keeping requirements."

» SPECIAL REPORT

time has shown that not to be true,” says John Hanson, executive director of Artifice Forensic Financial Services LLC in Washington. “Companies will still contend so and the point may, in some instances, have some merits, but with the increased passage and enforcement of anti-corruption/bribery laws by other countries—enforcement of those laws is now a trend—the playing field is even further leveled.

“One thing to be sure, the risks and costs associated with FCPA violations is huge and must be taken seriously,” Hanson continues. “The costs of losing a particular contract because one fails to pay a bribe to gain an unfair advantage in obtaining it is not worth the costs associated with getting caught doing it. What’s to stop a competitor, foreign or domestic, in such an instance reporting an alleged violation to authorities?”

Compliance can slow the speed of business, but the losses from a business can suffer from non-compliance argue for the cautious approach, Rodriguez says. “The Obama Administration recently launched an interagency review of U.S. export controls laws, the Export Control Reform Initiative, with the objective to reform the current U.S. export control regime.” The interagency review is in Phase I and most likely it will be a few years before the full scope of the proposed changes is approved and implemented.

Amending regulation and enforcement

“The main development is the export reform initiative which is still underway,” says Georgi. “This reform could create a single control list, a single licensing system, and a single agency. That said, while the current administration appears to be working most diligently on the reform effort, it is too soon to tell what the reforms will bring.

“While the full scope of the reform is unknown, the first real regulation to be issued is likely to be a regulation that should benefit companies, particularly foreign companies, that are parties to Technical Assistance Agreements (TAA) and Manufacturing License Agreements (MLA),” Georgi says. “Those companies currently have to identify all dual national and third country national employees who will work on the TAA or MLA or have access to the ITAR technology, including finding out information relating to past citizenships and country of birth. Obtaining such information can raise concerns under foreign anti-discrimination and privacy laws, however. It is expected that the

new ITAR regulations will ameliorate this problem although we won’t know until the new rule is issued how far it will go.”

Amendments are also being proposed for the U.S. Sentencing guidelines by the U.S. Sentencing Commission related corporate compliance and monitors.

“I don’t think that these changes will in particular affect enforcement, but may spur an even faster increase in the usage of monitors pursuant to settlement agreements between government agencies and the offending companies,” Hanson says. “In the world of FCPA enforcement this is not new, with nearly every settlement agreement—often called Deferred Prosecution Agreements or Non-Prosecution Agreements—used in such matters over the last few years requiring both remedial measures within the entities corporate compliance program and the use of a monitor to independently verify the entity’s compliance with that and other terms of the settlement agreements.”

Hanson was appointed as the monitor of a publicly traded government contracting company pursuant to a settlement between them and a federal U.S. agency, he says.

Avoiding compliance pitfalls

“Get experienced assistance,” Hanson recommends. “The laws and regulations are complex, the penalties grave, and the enforcement level high—all pointing to significant risk. Not only does such an advisor assist in preventing problems from occurring, but they serve as a potential mitigating factor should a problem occur and the government consider how to penalize the company.” However, many small businesses cannot afford to hire an attorney or a consultant, but still need to keep ahead of ITAR violations.

“You are better paying for an experienced team and just using them for the key issues than flying solo,” Georgi says. “But there are many things you can do on your own: hire or select in house an intelligent, motivated compliance person and send him/her to ITAR training provided by SIA or ACI or another solid ITAR training program. Have your trained person work with an outside expert to set up a good compliance program for your company. Roll out and educate your workforce on the program. Spend some money for an outside audit of your program to identify weaknesses. Correct the weaknesses and train again. It’s not cheap, but it is affordable. In fact, if you play in the ITAR sandbox, you can’t afford not to.”

Rodriguez agrees. “Attorney cost should not be an excuse for not setting up compliance programs. There are many affordable training classes available that are taught by attorneys and other services providers.”

“Ultimately, an entity cannot control its employees, subcontractors, agents, and representatives, who may make a personal decision to do something inconsistent with corporate policy and/or the law, so a company must demonstrate that it has

Electronics technology supplied to programs such as the P-8 reconnaissance aircraft are subject to International Traffic in Arms Regulations (ITAR).



taken and applied reasonable measures (with particular emphasis on the corporate compliance program and internal controls) to prevent, detect, and respond to such problems,” Hanson says.

Dual-use

One of the most confusing issues for experienced and green compliance officers is dual-use, Georgi says. “Dual-use items are items subject to EAR administered by the Department of Commerce Bureau of Industry and Security.” Generally speaking, if an item is subject to EAR, it cannot be subject to the ITAR and vice-versa—although there are one or two small pockets where dichotomy breaks down slightly. But you can take a dual-use item, modify it, and come up with an ITAR item.

Important ITAR links

There many things to consider when it comes to dual-use items; it depends on the situation or case, Young says. Some might believe that since an item or technology is not covered under ITAR and is available commercially, then it doesn't require an export license or controls. This could result in an item that really is classified as "Dual Use" on the Commerce Control List (CCL) being exported in violation of Export Laws. Careful screening must be done before exporting anything outside the U.S.

E-mail and compliance

Today many companies use global hubs by which to route their e-mail traffic, Young says. This can be a major compliance issue when the hub is outside the U.S. For example at some companies, "if you send out an e-mail to a colleague in the next office it is routed through a hub in another country, then sent back to your office. If that e-mail data is subject to ITAR controls, I just violated ITAR regulations by sending it out of the country."

In all his e-mails, Young places the following note at the bottom: "This e-mail and any attached files are Celestica proprietary and may be legally privileged. Do not e-mail export controlled technical data. If you are not the addressee, any disclosure, reproduction, copying, distribution, or other dissemination

or use of this communication is strictly prohibited. If you have received this transmission in error please notify the sender immediately and then delete this e-mail."

People really need to be careful when they send emails, "because once you hit send you have no guarantee where it will end up," Young says. If Young has material subject to ITAR controls that he needs to give to a colleague, he walks it over on USB stick or puts it on a protected FTP server, he says. Electronic information also needs to be protected when traveling overseas. "I tell all our employees that they must assume that all their text messages, e-mails, cell phone conversations, etc., are being recorded," Young says.

It is also wise for companies to begin considering the danger of social networking sites when doing compliance training, Young says. It might be advisable to limit activity on company sites to Facebook and LinkedIn unless the employee has undergone extensive compliance training—what they think may be an innocent comment could be a compliance violation. "Employees must be careful about providing information to foreign nationals, especially if a company deals with export controlled technology," Young adds.

Management support

Getting management support for compliance

programs is crucial, especially for small businesses, Young says. Company leadership needs to be aware that one fine could sink their entire business, he adds.

A lack of management support can foil a compliance program before it even gets off the ground, Rodriguez says. Too often management is more interested in the bottom line and feels that spending time dealing with compliance will cost them revenue, but the opposite is the case if they get caught. Management has to commit time and resources to compliance; it is not just a matter of applying for licenses, it requires detailed record-keeping and investments in training for all employees and senior management.

ITAR compliance is another part of risk management, says Richard Schulman, vice president of quality and ITAR technology control at Columbia Tech in Worcester, Mass. They went about it in a conservative, cautious way, hiring a consultant and taking training classes. Hiring the right compliance officer is crucial, Young says. "Export Compliance requires a background and understanding of export/import laws and a constant vigil to ensure your company is doing the right thing, every time." This individual has an appreciation and true understanding of compliance and how to make sure companies meet regulations and refrain from getting fined. ●

Lizbeth Rodríguez
OF counsel and attorney with Holland & Hart LLP in Denver, Colo., recommends sections of the U.S. Department of Commerce, Bureau of Industry and Security, U.S. Department of Treasury, Office of Foreign Assets Control, and U.S. State Department, Directorate of Defense Trade Controls, Web sites for those looking to get started with compliance.

For the Export Administration Regulations, visit

http://www.access.gpo.gov/bis/ear/ear_data.html#ccl.

For the International Traffic in Arms Regulations, visit

http://www.pmddtc.state.gov/regulations_laws/itar.html.

For guidance regarding the elements and implementation of an effective Export Compliance Management Program, visit

<http://www.bis.doc.gov/complianceandenforcement/emcp.htm>.

For general information on ITAR compliance requirements, visit

<http://www.pmddtc.state.gov/>.

For general information regarding U.S. trade sanction programs, visit

<http://www.treasury.gov/offices/enforcement/ofac/>.

For several lists of entities and individuals that have been denied export privileges or with whom U.S. parties are restricted to conduct business, visit

<http://www.bis.doc.gov/complianceandenforcement/liststocheck.htm>.

For frequently asked questions on Commerce Department export licensing, visit

<http://www.bis.doc.gov/exportlicensingqanda.htm>.

For a list of ITAR violation consent agreements going back to 1978, visit

http://www.pmddtc.state.gov/compliance/consent_agreements.html.

For a fact sheet of President Obama's Export Control Reform Initiative, visit

<http://www.whitehouse.gov/the-press-office/fact-sheet-presidents-export-control-reform-initiative>

For more information on Holland & Hart's export practice, visit

<http://www.hollandhart.com/practice.cfm?IDName=DeptID&ID=198>.

TECHNOLOGY FOCUS

Soldier systems at the technological crossroads

Technologies for the warfighter must run a cruel gauntlet of size, weight, and power consumption, as well as enhanced capability and affordability, before they can take their places alongside the most promising network-centric systems on the digital battlefield.

By **JOHN KELLER**

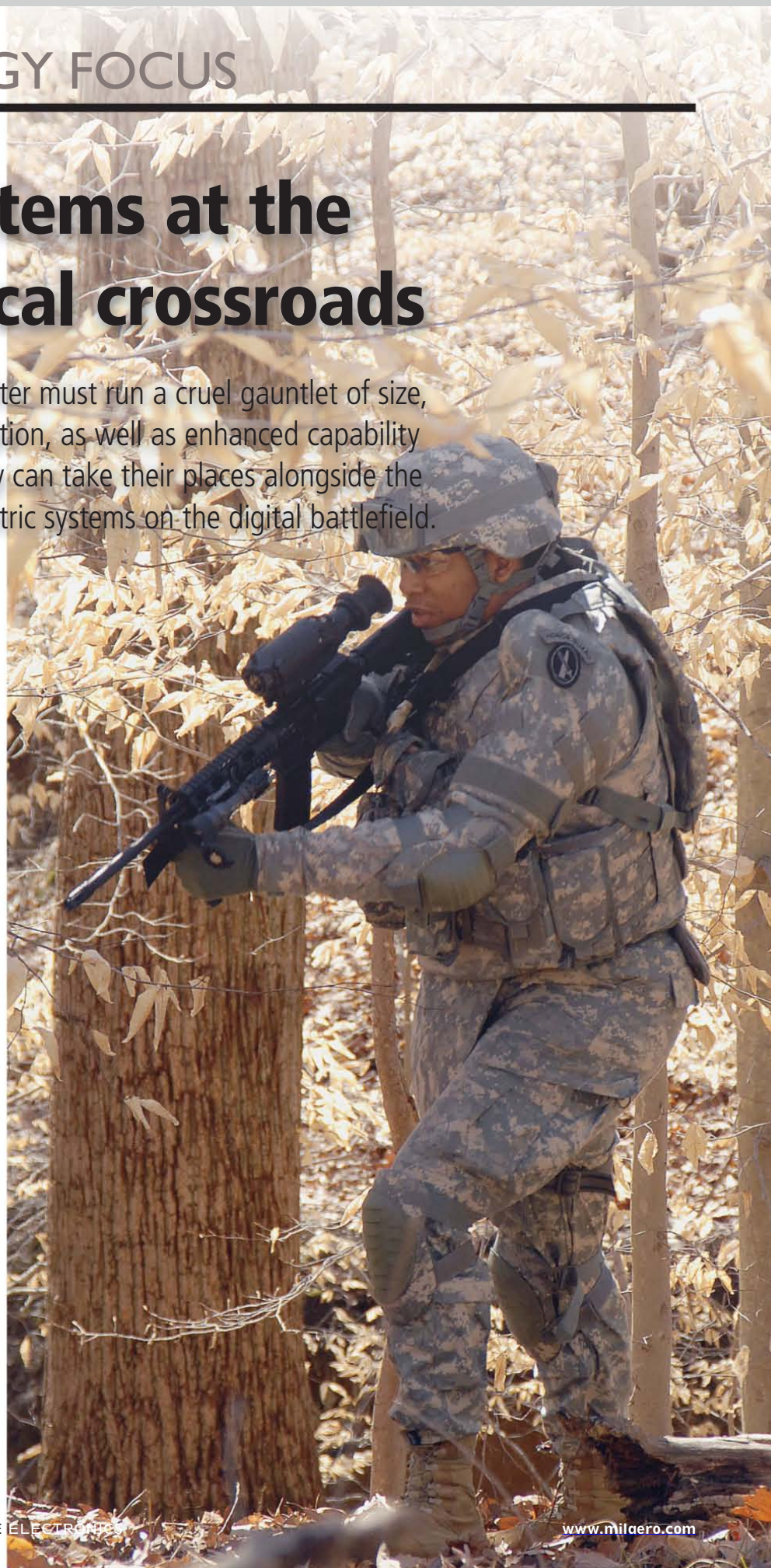
For the boots-on-the-ground combat soldier, size and weight is everything. Each combat soldier can carry only a finite amount of gear into battle—loads that often approach 100 pounds per warfighter. This means he and his commanders need to strike the right balance of weapons, sensors, communications, food, water, and survival equipment to give him the best chance of achieving the mission and getting back alive.

Weapons and ammunition are not getting noticeably smaller or more lightweight. Neither is food, water, or survival equipment. For the infantry soldier, about the only way he can enhance his fighting capability is to reduce the size of sensors, communications, and other soldier systems that involve electronics and electro-optics. Reducing the size and weight of electronic devices, while maintaining or improving capability, are among the chief concerns of today's soldier systems designer.

Although today's soldier systems technology chiefly concerns reducing size, weight, and power, at the same time soldiers in the field are demanding ever-increasing capability in computing, communications, navigation and guidance, wireless networking, and—perhaps above all—sensors to help infantry soldiers see at night and in bad weather, as well as to measure distances and designate targets.

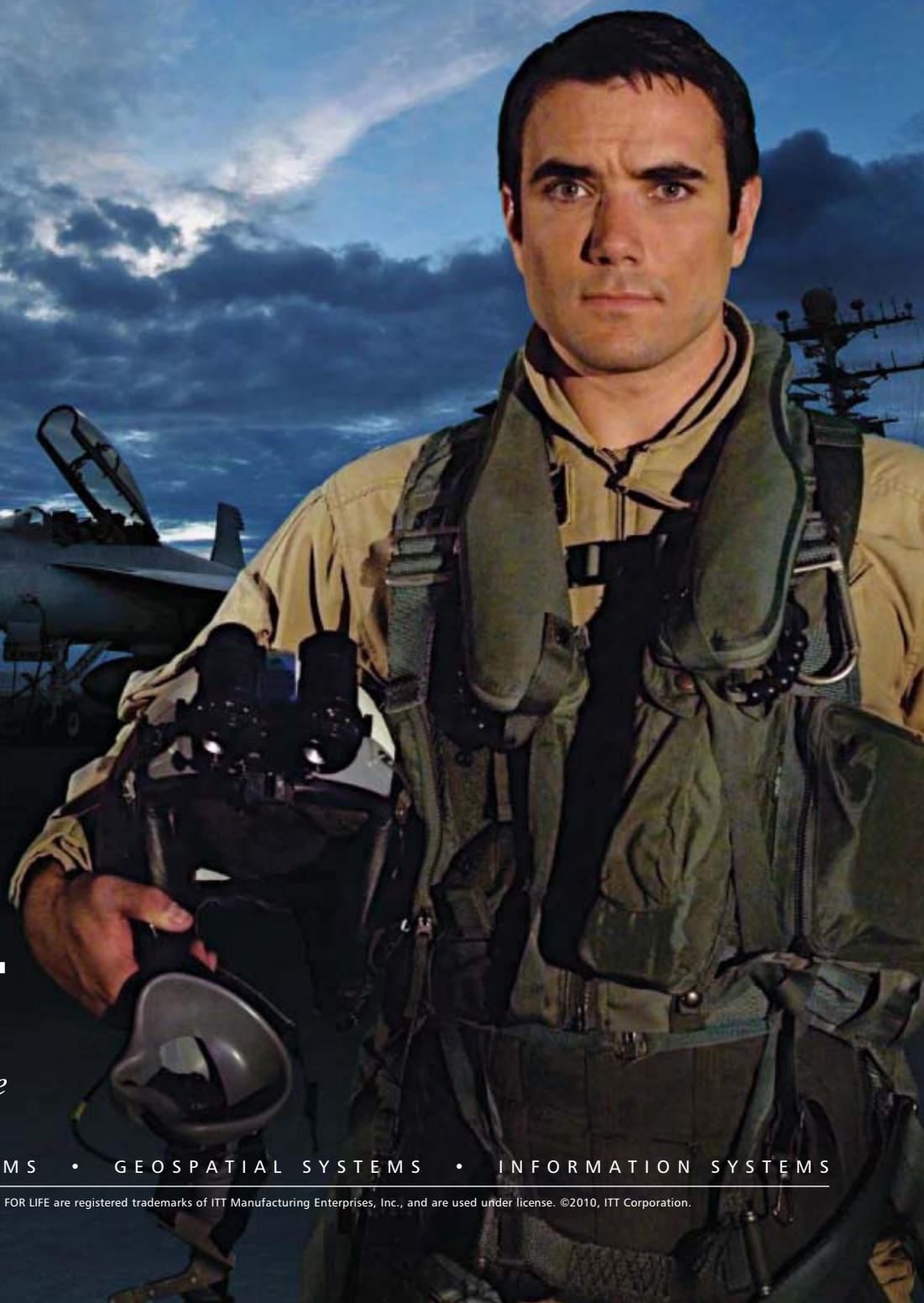
As U.S. military operations continue in Iraq and Afghanistan, U.S. military forces

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have put a premium on developing capable, lightweight soldier systems for the past several years—often as a higher priority than traditional big-ticket military platforms, such as jet fighters, main battle tanks, and surface warships.

“Look at the budget,” says David Strong, vice president of marketing for the FLIR Systems Inc. government systems division in Wilsonville, Ore. “A very large share of the overall DOD budget is for supporting and equipping the soldiers. Putting a priority on soldier systems has to be part of the thought process. Most of the Future Combat Systems program was cancelled, and yet we need to get capability into the hands of soldiers.”

Size, weight, and power

The typical combat soldier, even though he has superior training and technology, is still human, so his or her ability to carry heavy loads is limited. “Lightweight body armor is over 30 pounds, and the soldier has to carry water and ammunition for



Panasonic is using circular polarization technology on the screens of its Toughbook handheld computers to cut glare and make the devices readable in bright sunlight.

three days. The backdrop for everything is the need to unburden the soldier, which is getting the weight out of the systems,” says Michael Lewis, vice president and general manager of soldier and vehicle solutions at the BAE Systems Electronics Solutions Sector in Nashua, N.H. “There is a

big premium on lightweight systems.”

These technologies and systems also must be rugged enough to operate in Iraq, Afghanistan, and other areas of the globe where the U.S. and its allies are involved in military operations.

These areas of South Asia offer extremes in weather and temperatures, which places a premium on equipping soldiers to avoid fatigue during long, dangerous missions. “The soldier by his nature has a fixed load he can carry,” points out Kurt Grigg, director of marketing for surface solutions at Rockwell Collins in Cedar Rapids, Iowa. “He has demand for power as he gets more electronics, and he has to make some tough tradeoffs, such as, do I carry more batteries or more water?”

Recent developments in soldier systems technology may have reached a tipping point, in which existing technologies are sufficiently small and lightweight to meet the latest Army requirements for infantry warfighters. “The current generation of technologies is meeting the requirements, as written,” says Grigg.

“Prior generations of deliverables did not meet what the Army and other forces specified, yet lately we have made great strides in advancing the technologies to meet the objectives,” Grigg says. FLIR’s Strong says he agrees. “We are at that stage now where we have introduced over the last year a complete line of sensors that span the range of soldier solutions, vehicle vision solutions, and vehicle RSTA [reconnaissance, surveillance, and target acquisition] that meet the soldier’s requirements.”

Despite broad improvements

Improvements in uncooled infrared sensor technology is yielding lightweight thermal weapon sights, like the one shown at left, which ultimately may be data linked to other soldiers and to upper-echelon commanders.



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in the size, weight, and power consumption of the latest soldier systems, “you are never done,” Grigg points out. “As we continue to advance electronics, we have enhanced demands for more; the mindset drives the expectation for more processing horsepower to run the more complex applications.” Echoes Strong, “Size, weight, and power consumption will continue to decrease; that’s a steady trend as the technology develops.”

Enhanced capability

One of the primary areas for soldier systems involves uncooled infrared sensors for night vision and situational awareness in fog, dust, and smoke. These sensors have become extremely small, lightweight, and rugged. “Night vision in all its forms is no longer a tool; it’s a necessity,” says FLIR’s Strong. “Every little outpost needs infrared nightvision capability.”

Uncooled infrared sensors by design are substantially smaller and more lightweight than their cooled counterparts because these devices operate at ambient temperatures while retaining their sensitivity to infrared light.

“ISR [intelligence, surveillance,

and reconnaissance] is a huge topic in soldier systems,” says FLIR’s Strong. “We are seeing activity in putting our sensors into multispectral and multisensor systems to blend IR and TV cameras, and basing them on vehicles. We have a bunch of sensors going onto MRAPs [mine-resistant, ambush-protected vehicles]. Vehicles need

it so [soldiers] can operate at night and see down the road in the daytime in smoke, dust, and fog.”

Designers of soldier-carried sensor systems still have a ways to go, however, not only to package their technologies for the battlefield, but also to keep the technology ahead of U.S. and allied adversaries.



The Micro DAGR global positioning system receiver, shown above, is among the tiny, lightweight systems today’s soldier carries into the field to increase his effectiveness and lethality.

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Small electro-optical sensor technology is enabling new applications that blend several kinds of infrared sensors, as well as laser measurement units and laser target designators.

"We have our lead in night vision, but we are not as far ahead as we used to be," says BAE Systems' Lewis. "There is strong interest in shortwave IR and other capabilities to see multiple bands at once, or see in other bands. Our customers always put a premium on great performance, but at a practical size, weight, power, and cost."

The ability to shrink uncooled sensor technology also makes it easier to create multispectral sensor systems that blend the best of infrared, visible light, and amplified light. "Right now, we are blending uncooled longwave infrared and image-intensified night vision," says FLIR's Strong. "We are going to start seeing multi-band or dual-band infrared also coming into play."

Dual-band infrared blends longwave and midwave infrared sensors—each of which have specific strengths and weaknesses that when combined can be greater than the sum of their parts. Midwave IR, for example, might see better through windows than longwave IR. One kind of sensor also sees better through foliage, and

better through smoke and fog. Blend outputs from the two sensors and users will have the best of both worlds. Small, lightweight designs can enable those kinds of developments for soldiers to take comfortably into battle.

Blending outputs from two or more infrared sensors "is almost like going from black-and-white to color vision," Strong says. "We will be ready to deploy that technology in a year or two, and in five-plus years we will see more multispectral infrared. The key is to make it more affordable."

Once optical sensors gather imagery from the battlefield, potential users of this information need a way to display it easily on small, lightweight displays rugged enough for military operations, and that is where developments in handheld computers and digital displays come in. Soldiers today "want products that are readable in the bright sunshine," says Fed De Gastye, business development manager of federal business at Panasonic Solutions Co. in Secaucus, N.J.

Panasonic is using what the company calls circular polarization on the Toughbook 10 and H-1 Field portable and handheld computers that are designed for military and law-enforcement applications. Circular polarization uses a special film on computer screens that make them more viewable in bright sunshine by dulling screen glare.

When it comes to lightweight computers for the battlefield, Panasonic designers are considering improvements to systems to include voice activation, as well as improved security for wireless data networking to enable military computer users to operate their machines on the move without risk of interference or interception by the enemy.

"The digital battlefield is here today," says BAE Systems' Lewis. "It is a question of how fast we will progress. Already we can export imagery to handheld PDAs and COTS telephones, which are frequently taken into the field, to share this information. Devices are [required] to export video

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and to interface with things like the Land Warrior system.”

When it comes to tactical networking on the battlefield, Rockwell Collins is one of the experts. Rockwell Collins, along with Raytheon and General Dynamics, is competing for a U.S. Army program called Nett Warrior—named in June for World War II Medal of Honor recipient Col. Robert B. Nett.

Nett Warrior, which concentrates on establishing digital data links among soldiers fighting together, essentially picks up where Land Warrior leaves off. Nett Warrior technology is worn on a soldier's body to provide networked situational awareness

“Soldier systems technology constantly faces a stringent set of requirements. If these systems are to be developed and fielded, however, no requirement is as immediate and crucial as affordability.”

by blending radio, global positioning system, helmet-mounted display, and a handheld data input device. Wiring is integrated into a protective vest.

“Nett Warrior consists of a body-worn computer system—something that lets you run software—a means of displaying that data to the soldier, and a means of sharing that information among those in the battle space,” Grigg says.

This system, which should be fielded around 2013, will enable soldiers to see their locations, the locations of their buddies, and the locations of known enemies on a moving map. “The intent is to provide situational awareness,” Grigg explains. Although the enabling technologies for Nett Warrior exist today, “the drive is to get to more power-efficient, smaller, lighter-weight radios, computers, and display technologies,” he says.

Affordable technology

Soldier systems technology constantly faces a stringent set of requirements. If these systems are to be developed and fielded, however, no requirement is as immediate and crucial as affordability. “[U.S. Defense Secretary Robert] Gates has said it, there is a crunch coming in the U.S. defense budget,” points out FLIR's Strong. “The DOD budgets are going to shrink, there will not be as much money as there has been, and it is already starting. In the next fiscal years—2011 and 2012—we will see a real crunch on the acquisition side.”

What that means is nothing can be even remotely considered to be too expensive if the technology will ever make it to the field. Systems developers perhaps learned that lesson with the cancellation of the Army's Future Combat Systems (FCS) program.

“The DOD is going to have to start looking very hard at affordability,” Strong says. “If systems are not affordable, their developers need to make a change. Our strategy is taking uncooled infrared technology, with battery power, instant-on capability, lightweight, small, and affordable relative to other technologies.”

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OPINION

C++ software development for DO-178 safety-critical applications

Use of the C++ programming language may cause concern, delays, and rework when it comes to DO-178B compliance.

By **DAVID BEBERMAN AND JOE WLAD**

While use of the C++ programming language has increased in the past decade, choosing this language could hinder efforts to comply with certification standards, such as RTCA/DO-178B, unless developers take great care.

The lack of standard guidance and rules leads many certification representatives to review an applicant closely who is using C++, which can result in project delays or rework.

In 2002, the Certification Authorities Software Team (CAST) published guidance that identified common problems with C++ in DO-178B-compliant applications (see CAST paper #8, http://www.faa.gov/aircraft/air_cert/design_approvals/air_software/). The common C++ usage concerns raised by CAST include compile and run-time issues.

"Many C++ features, if not properly controlled and verified, can result in software code that is non-deterministic, unused, or difficult to verify, and whose configuration can change depending on the run-time state of the system," CAST states. Compile-time issues include dead/deactivated code, encapsulation, inheritance, and overloading. The run-time issues, meanwhile, include dynamic binding/dispatch and polymorphism. Using these features, unfortunately, can make it difficult to comply with DO-178B objectives.

In the past decade, many organizations have defined ad-hoc, safety-critical subsets of C++ to achieve DO-178B compliance. These efforts, while successful, did not address the need for a universally accepted subset.

In 2004, the U.S. Federal Aviation Administration (FAA) enlisted the National Aeronautics and Space Administration's

(NASA) support for a project called Object-Oriented Technology in Aviation (OOTiA), which went beyond just C++ issues. This project sponsored research and conducted workshops designed to identify concerns about OOT relevant to safety and certification. These efforts culminated in the publication of a handbook for object-oriented usage in safety-critical applications and pro-

"Many C++ features, if not properly controlled and verified, can result in software code that is non-deterministic, unused, or difficult to verify, and whose configuration can change depending on the run-time state of the system."

vided guidance to certification representatives who are approving object-oriented applications to DO-178B objectives.

DO-178B challenges

The FAA strongly recommends using RTCA/DO-178B as the vehicle to demonstrate that software is airworthy. Published in 1992 (a revision, called DO-178C, is to be published within the next 12 months), DO-178B specifies 66 objectives that must be met in order to meet the highest level of safety (Level A).

Certification to Level A means that one must show that high- and low-level requirements have been tested and that the associated run-time code (including the compiler behavior) has been exercised in these tests. Additionally, one must also demonstrate traceability between the requirements, design, code, and tests, as well as complete, independent reviews of the requirements, design, source code, and tests.

Verification to DO-178B objectives is a

labor-intensive effort. An engineering team will spend between one and four hours verifying each line of code to demonstrate compliance to Level A. To ease this effort, tools are often employed to assist in satisfying DO-178B objectives.

For example, commercial tools are available to help identify which code structures are exercised during requirements-based tests. These structural coverage analysis tools (as well as any verification tool) must be qualified in accordance with RTCA/DO-178B, section 12.2.

For C++ developers, DO-178B compliance is more onerous because of the potentially complex nature of C++ code. Features such as inheritance, overloading, and

polymorphism will complicate traceability and structural coverage, and potentially lead to code that contains latent defects of unexplored behavior.

DO-178B compliance made simple

Historically, programmers have relied on standards released by the Motor Industry Software Reliability Association (MISRA) to ensure development of deterministic C and C++ code. MISRA-C specifies a "safe" subset of the C language in the form of 121 required and 20 advisory rules, while MISRA-C++ defines 228 rules.

Now, for the first time, there is a commercially available and DO-178B-qualified static code analyzer that ensures compliance to a safe C++ subset. This tool, QA C++ from Programming Research Inc., assists developers and certification authorities in producing, verifying, and approving C++ code in Level A systems.

Specifically, QA C++ allows developers to take partial, automatic credit for two

key DO-178B objectives. First, concerning DO-178B paragraph 6.3.4d, QA C++ provides a wide range of configurable language checks to support verification that the source code conforms to a specific source code standard. Second, relevant to DO-178B paragraph 6.3.4f, QA C++ is used to perform a number of checks that support source code consistency verification.

QA C++ comes with a DO-178B tool qualification package (produced by Verocel Inc., an independent third party) including: the tool qualification plan, tool operational requirements document, tool qualification document, test harness qualification document, a user's manual, and a user's guide.

QA C++ is a deep flow static analyzer for C++ code. The tool performs source code analysis on a file-by-file and complete project basis to identify unsafe usage of the C++ language. The tool can also identify language usage which is not compliant with the ISO C++ standard (ISO/IEC 14882:2003), or language constructs which are classified as giving rise to indeterminate, undefined, or implementation-defined behavior.

C++ application developers can define or use their own coding standards and configure the QA C++ tool to detect non-compliance to their standard. Use of the tool will save considerable time and reduce certification risk because it will catch all coding standard violations and help ensure conformance to safe and certifiable C++ subset as identified in the CAST-8 issue paper.

QA C++ will detect and report warning messages for problem areas, such as overly complex code, type violations, overloading of operators, constructors which may lead to exceptions or indeterminate states, pointer arithmetic, and hundreds of other risky programming practices. Now safety-critical developers and certification authorities have a common foundation upon which to approve C++ applications for use in airborne systems.

Developers who choose to use the qualified QA C++ tool, must define their intention to use the tool in their software certification plan. This plan, called the Plan for Software Aspects of Certification (PSAC) must be submitted to the certification authorities (in the U.S., the FAA) for approval prior to commencing a certification effort.


The certification authority will examine

the tool qualification evidence and also ensure the developer uses the tool in a manner prescribed by the tool qualification package. Using a predefined and pre-qualified tool such as QA C++ will reduce certification risk and reduce the effort involved in the code review process, which requires certification to RTCA/DO-178B. ●

Joe Wlad, principal and founder of Safe Software Consulting Inc. in Alameda, Calif., can be reached by e-mail at joe@safesoftwareconsulting.com. David Beberman, the North America operations manager for Programming Research Inc. in Boston, can be reached by e-mail at david_bebberman@programmingresearch.com.

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PRODUCT INTELLIGENCE

Weighing waveform analyzer options

By **COURTNEY E. HOWARD**

Not all waveform analyzers are the same, and so professionals should carefully consider the specifications and capabilities of the models available and weigh them against the specific needs of their military and aerospace application.

First, it is important to understand the relationship between the waveform to be analyzed and the specifications of the equipment performing the signal analysis, explains Darren McCarthy, RF technical marketing manager at Tektronix in Wilsonville, Ore. The most common method of analyzing modern waveforms is the use of vector signal analyzers, or fast Fourier transform (FFT)-based analysis techniques. "It is important that all the waveform information is captured within the communication channel for a finite period of time; however, most dynamic range specifications on spectrum analyzers are represented by swept analysis techniques and have no correlation to the vector analysis applications," McCarthy describes.

The system's ability to capture and analyze not only repetitive signals, but also intermittent or time-varying signals is another major consideration when selecting the optimal waveform analyzer. "The true power of a waveform analyzer comes with its ability not only to analyze what signals are supposed to be present, but also to analyze the signals that are not supposed to be there," says Sue Guzman, Aeroflex Cupertino general manager and vice president of Aeroflex Test Solutions in Cupertino, Calif. "Critical to this ability is the need for simultaneously displaying the captured waveform in all three domains: time, frequency, and modulation."

When selecting a signal analyzer to evaluate waveforms, consider RF frequency, information or acquisition bandwidth, and signal fidelity (dynamic range) within the acquisition bandwidth and at the frequency of interest, McCarthy advises. "You need to be able to tune to the frequency of interest," he says. Information bandwidth relates to the instantaneous FFT bandwidth that can be continually processed for analysis. "If your waveform hops over multiple channels, and you are interested in the analysis of the waveform during the hopping transitions, the information bandwidth of your signal analyzer must be able to capture the entire hopping transitions over multiple channels."

Signal fidelity also needs to be considered under the representative waveform conditions. "At microwave frequencies, in order to enable wide instantaneous bandwidths, many spectrum analyzers need to remove preselection filters that limit bandwidth and distort the incoming signal," McCarthy advises. "During these conditions, the analyzer specifications no longer apply."

Today's technologies provide a much more capable platform for waveform analyzers, including wider instantaneous bandwidths, much higher speed, much deeper signal memory, and many more software analysis features that, at one time, only were available as post-processing capabilities on computers separate from the waveform analyzer itself," Guzman admits. "The instantaneous bandwidth available determines the fastest pulses that can be analyzed or determines the widest frequency signal which can be measured," she describes.



The system should offer modularity, enabling upgrades as better performing analog-to-digital converters (ADCs) and faster processors become available, without causing the user to purchase an entirely new system each time, Guzman adds. The breadth of analysis capability present in the software/firmware of the system, especially the variety of data visualization options and the number of different demodulation types supported, is key, she says.

"Software option flexibility enables the analyzer to be used for multiple purposes: phase noise testing, signal source tester, peak/channel power meter, modulation analyzer, oscilloscopes, and frequency counter," McCarthy explains, describing the new Tektronix RSA6120A. As a result, such systems—capable of many different automated scalar and vector pulse analysis parameters, for example—can replace several instruments usually required for accurate pulse performance characterization.

The depth and speed of the signal memory available, which determines how long of a waveform recording can be taken or determines how well intermittent signals can be captured, is another important consideration, Guzman describes. "Longer waveform recordings capture a more complete picture of the signal or environment being tested."

The measurement utility and performance can give you the confidence to design the most advanced radio and radar applications, says McCarthy. "Read the specifications, and ask how they apply to your waveform analysis needs."

Do not lock yourself into a corner, Guzman cautions. "Select one with the hardware modularity to adapt to newer ADC and processing capability, and with a software/firmware architecture that allows the system to add new demodulation or analysis functions. Invest in a test solution that can grow with you, not one that traps you in the past." ●

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ELECTRO-OPTICS WATCH

Raytheon, Air Force ready space sensor for first-of-its-kind military use

By **COURTNEY E. HOWARD**

EL SEGUNDO, Calif.—Raytheon Company's hyperspectral imaging sensor, called ARTEMIS, is being prepared for a first-of-its-kind tactical military role in support of the Air Force Space Command.

The company's Advanced Responsive Tactically Effective Military Imaging Spectrometer has completed its one-year experimental mission aboard the Air Force Research Laboratory's Tactical Satellite-3. Based on that mission, Raytheon has been

notified that the Air Force Space Command will take control of TacSat-3 with the intent to use ARTEMIS in an operational capacity.

"The ARTEMIS hyperspectral imager gives military commanders an important new advantage in the asymmetric battlefield," explains Bill Hart, vice president at Raytheon Space Systems. "ARTEMIS can detect various manmade and natural materials, which adds a fundamentally

new capability for the DOD."

Unlike visible imagers, hyperspectral sensors capture light across a wide swath of the electromagnetic spectrum, providing unprecedented spectral detail. That spectral information produces a distinct "signature," which can be compared against the spectral signatures of known objects to rapidly identify potential areas of interest.

The ARTEMIS hyperspectral imager combines spectral information with geo-location coordinates in an easy-to-read map. This information is then sent directly to troops on the ground in near real time.

"Air Force Space Command looks forward to taking ownership of the TacSat-3 ARTEMIS system," says Lt. Col. Ryan Pendleton, Air Force Space Command, Chief, Operationally Responsive Space Integration. "We plan to operationalize the system as soon as possible to provide direct benefit to warfighters."

TacSat-3 originated as part of the U.S. Department of Defense's operationally responsive space initiative, which seeks to provide field commanders flexible, affordable options for obtaining real-time tactical surveillance data from space. Aided by the ORS Office, and led by the Air Force Research Laboratory, the TacSat-3 program was designed to demonstrate the feasibility of developing and launching a military payload within extremely tight schedule and budget constraints.

"TacSat-3 has been a pathfinder to explore concepts of operation for future ORS systems and demonstrates how great things can be achieved on a small budget and in a short time," says Dr. Peter Wegner, director of the Pentagon's ORS Office. "It has also demonstrated the utility of hyperspectral information to benefit soldiers, sailors, airmen, and Marines around the world."

Raytheon is discussing with several government customers opportunities for rapidly deploying additional hyperspectral space sensors. "Based on our experience on TacSat-3, we're ready to build operational hyperspectral systems like ARTEMIS quickly and affordably," says Raytheon's Hart. ●

KVH to provide fiber-optic gyros to stabilize fire-control systems in remote weapons stations on armored vehicles

MIDDLETOWN, R.I.—KVH Industries Inc. in Middletown, R.I., is providing fiber-optic gyros (FOGs) to be used in remote weapons stations (RWS) that enable gunners on combat vehicles to operate, aim, and fire from inside their armored vehicles, away from hostile fire.

KVH is providing the electro-optical technology under terms of a \$7.1 million order from a major defense contractor. Although KVH is not naming its customer, major suppliers of U.S. remote weapons stations

include Kongsberg Defence Systems in Kongsberg, Norway, and EOS Technologies Inc. in Tucson, Ariz.

Kongsberg Defence Systems makes the U.S. Army M151 Protector remote weapons station, which is in common use on Stryker armored vehicles. The Protector can be fitted with machine guns, grenade launchers, Javelin anti-tank guided missiles, and the Hellfire missile.

KVH's FOGs provide optical stabilization and weapon recoil control for RWS units, while ensuring that the weapon stays on target whether the vehicle is stationary or on the move.



The U.S. has ordered more than 10,000 remote weapons stations for its combat vehicles as part of a program called the Common Remotely Operated Weapons Station (CROWS)—a three-axis stabilized mount equipped with a sensor suite and fire-control software that enables on-the-move

target acquisition and first-burst target engagement. The current provider of CROWS is Kongsberg Defence Systems.

Capable of target engagement under day and night conditions, the CROWS sensor suite includes a daytime video camera, thermal camera, and laser rangefinder—all of which are stabilized by KVH FOGs.

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» ELECTRO-OPTICS WATCH

KVH from page 27

KVH supplied the fiber-optic gyros to Recon Optical (now EOS Technologies) for the U.S. Army's original CROWS program in 2005, and later won a contract with Kongsberg for the CROWS II program. The U.S. Army has announced a planned

CROWS III program that may add an additional 19,000 RWS systems to its inventory.

KVH engineers are working on smaller, lower-cost designs they believe will be particularly well suited for the CROWS III program.

For more information, visit KVH Industries online at www.kvh.com.

SAIC to create GRIN lenses for small, lightweight applications

By **JOHN KELLER**

ARLINGTON, Va.—Optical researchers at Science Applications International Corp. (SAIC) in McLean, Va., are attempting to create manufacturable gradient index (GRIN) optical lenses for size- and weight-constrained military electro-optics applications. SAIC is doing the research work under terms of a \$9.5 million contract from the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., for the Manufacturable Gradient Index Optics (M-GRIN) program.

The performance of traditional lenses in military systems often is limited by their optical elements, which dominate system weight and cost, and force tradeoffs between focal length, field of view, resolution, and range. In traditional optics, light rays undergo refraction at the surfaces of each element, but travel in straight lines within the lens. Correcting for aberrations leads to large, heavy, complex designs, or greater losses, lower image quality, and manufacturing difficulties.

GRIN technology, however, has the potential to reduce size, weight, element count, and assembly cost of sophisticated optics, DARPA officials say. Control of the internal refraction in GRIN optics steers light in curved trajectories through the lens, varying the index of refraction and increasing the design space to include the entire volume of its optical elements.

DARPA is asking SAIC optical experts to advance GRIN design and fabrication technology from proof-of-concept to low-rate initial production. SAIC will develop new lens design methods and tools that will lead to a scalable manufacturing system able to produce lenses in numbers from one to thousands.

SAIC optical experts will come up with ways to manufacture GRIN optical assemblies for a high-performance color camera lens and a two-color solar concentrator, with emphases on materials development, optical element design, test and evaluation methods, and manufacturing.

For more, visit SAIC online at www.saic.com, or DARPA at www.darpa.mil.

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PRODUCT APPLICATIONS

COMMAND AND CONTROL

U.S. Coast Guard selects Sabtech Industries Shipboard Peripheral Replacement System for MK 92 FCS upgrade

U.S. Coast Guard officials have chosen the Shipboard Peripheral Replacement System (SPRS) from Sabtech Industries in Yorba Linda, Calif., to upgrade the Mk 92 Fire Control System (FCS) on its medium- and high-endurance cutters. Coast Guard engineers will employ the Shipboard Peripheral Replacement System to replace a key, but obsolescent component of the combat system aboard the current fleet of cutters.

An aging but critical component of the Mk 92 FCS is the OJ-172 Data Exchange Auxiliary Console (DEAC). The DEAC is the only load device for the Weapons Control Processor (WCP) computer that runs the Mk 92 system, reveals a Sabtech spokesperson. If the DEAC is not operational, the computer cannot be loaded and the ship's ability to detect, track, and engage air and surface targets



is down. Because it is unreliable and expensive to maintain, the Coast Guard sought a replacement for the vintage 1960s DEAC to ensure that the Mk 92 is always ready to support the mission.

After years of review by the Naval Surface Warfare Center (NSWC) Mk 92 In-Service Engineering Agent (ISEA), Sabtech's SPRS was selected over other options based on economy, reliability, user friendliness, and overall best value, adds a company official. SPRS is a plug-in replacement for the DEAC that is virtually maintenance-free. It replaces the DEAC's magnetic tape drives with removable hard drives, completely eliminating dependence on unreliable and increasingly scarce tape media. The DEAC's teletype I/O console is replaced with a modern display and keyboard.

By replacing the DEAC with SPRS, Sabtech helps to modernize the Coast Guard's fleet and extend the service life of these valuable assets. Installations are scheduled to begin this year.

BATTERIES

EaglePicher nickel-hydrogen batteries power PS IIF SV-1 global positioning satellite

EaglePicher Technologies LLC has supplied two nickel-hydrogen batteries to Boeing in support of the GPS IIF Space Vehicle 1 (SV-1) satellite. The SV-1 satellite, which launched from Cape Canaveral on May 27, 2010, is the first in a series of 12 next-generation GPS Block IIF satellites, and EaglePicher is contracted to supply batteries for all the series.

EaglePicher's 16-cell, 75 ampere-hour batteries will power the satellite during eclipse. The environmentally-friendly battery chemistry includes excellent over-charge capability, as well as available strain gages and associated electronics that provide the customer with accurate state-of-charge monitoring.

The GPS IIF program is an upgrade of the original GPS, a worldwide timing and navigation system that uses 24 satellites positioned in orbit approximately 12,000 miles above the Earth's surface.

The satellites continuously transmit digital radio signals pertaining to the exact time using atomic clocks and exact location of the satellites. By referring to signals transmitted by four satellites, the GPS can be used to calculate longitude, latitude, and altitude.

The Department of Defense originally developed the GPS for all-weather military applications, but the system is available at no additional charge for civilians and commerce.

RF AND MICROWAVE

Cobham to supply microwave modules for air- and ground-launched missiles in \$17.4 million contract from Raytheon

RF and microwave specialists at the Cobham plc Sensor Systems segment in San Diego will provide microwave modules for ground-to-ground and air-to-ground missile systems built by Raytheon Co. under terms of a new \$17.4 million contract.

The contract comes from the Raytheon Co. Missile Systems unit in Tucson, Ariz.

Cobham Sensor Systems designs and manufactures active and passive microwave components, assemblies and sub-systems, composites and radomes for the aerospace and defense industry.

BOARD PRODUCTS

LaBarge to provide printed circuit cards for Raytheon's Rolling Airframe Missile system

Engineers at Raytheon Missile Systems in Tucson, Ariz., needed printed circuit card assemblies for the RIM-116 Rolling Airframe Missile (RAM) surface-to-air missile for naval surface warships. They found their solution from LaBarge Inc. in St. Louis.

Raytheon is awarding a \$1.2 million

contract to LaBarge to provide board products for the RAM system. LaBarge also is providing wiring harnesses for the Rolling Airframe Missile system. RAM is a small, lightweight, infrared-guided missile used by navies in the U.S., Turkey, Germany, Greece, Saudi Arabia, Egypt, and South Korea.

The RAM's onboard Mk-49 launcher stores 21 missiles. On U.S. Navy ships it is integrated with the AN/SWY-2 and ship self defense system combat systems. LaBarge will do the work at its Tulsa, Okla., facility, and should be finished by next year.

"LaBarge has produced a variety of complex wiring harnesses for the RAM missile system for two decades. This contract expands LaBarge's support of Raytheon's missile system to include electronic assemblies," says Craig LaBarge, chief executive officer and president.

For more information, visit LaBarge online at www.labarge.com.



» PRODUCT APPLICATIONS

BATTERIES

Ultralife to provide military batteries and battery chargers for U.S. Army Land Warrior infantry technology program

Ultralife Corp. in Newark, N.Y., will provide the U.S. Army Land Warrior program with lithium-ion rechargeable batteries as

well as vehicle, bulk, and individual soldier-based military battery chargers under terms of a \$2.5 million contract.

Land Warrior was originally developed as a man-portable power system to support an integrated, modular fighting system that uses technology to enhance individual soldier's close combat tactical awareness,



lethality, and survivability.

Ultralife won a potential \$26.9 million five-year contract from the U.S. Defense Logistics Agency for three kinds of military batteries for military night-vision goggles, SINGARS radios, and thermal weapon sights. For more information, visit Ultralife Corp. online at www.ultralifecorp.com.

SENSOR PROCESSING

Navy looks to Vista Research for persistent-surveillance radar processor sensors for tethered aerostats

Remote sensing experts at the U.S. Naval Air Warfare Center Aircraft Division Lakehurst at Lakehurst Naval Air Station, N.J., needed advanced land radar processor (LRP) sensor payloads for persistent ground surveillance able to cue walking humans and vehicles. They found their solution from Vista Research Inc. in Sunnyvale, Calif.

Navy officials awarded a \$24.9 million, 37-month contract to Vista Research as part of the Persistent Ground Surveillance System Technologies and Payloads program to develop radar processors for mobile platforms and tethered aerostats to provide real-time, networked 360-degree detection and tracking capability, with land clutter and false alarm rejection.

These sensors and surveillance systems are for persistent surveillance in military contingency operations outside the continental U.S. Vista Research engineers will create rapid prototypes to demonstrate advanced sensors for persistent surveillance on tethered unmanned platforms, as well as unmanned airborne platforms.



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PRODUCT APPLICATIONS

Vista Research experts will concentrate on sensors, sensor data processing and sensors systems, modeling of the sensor, communication techniques between the sensors and platforms, interfaces, the fusion and exploitation of multi-source sensor data, advanced payload platforms and its integration with sensors/payloads, as well as any other technique to develop advanced persistent surveillance capabilities quickly and at affordable costs.

Navy researchers at Lakehurst NAS awarded a separate \$23.2 million contract under the Persistent Ground Surveillance System Technologies and Payloads program to Stara Technologies Inc. in Gilbert, Ariz.

Stara experts will research, evaluate, and integrate prototype technologies that can provide forward operating bases with a persistent ground surveillance system (PGSS) capability, including identifying technologies that remotely can detect the presence of humans and automobiles, as well as locate the origin of incoming rounds.

Stara Technologies engineers also are developing inexpensive platforms on which to mount this technology, and are looking into renewable power sources to make the systems operate entirely through a green, self-sufficient power source.

For more information, visit Naval Air Warfare Center Aircraft Division Lakehurst online at www.navair.navy.mil/hawcad, or Vista Research at www.vistaresearchinc.us.

AVIONICS

Real-time aircraft predictive maintenance system from Boeing to go to Jade Cargo's fleet of 747-400 jets

Six Boeing 747-400 cargo jumbo jets at an international air cargo company will receive a maintenance-based information system from the Boeing Co. in Seattle that will help the carrier with predictive maintenance on its fleet of cargo jets.

Jade Cargo International Co. Ltd. in Shenzhen, China, will use the Boeing Airplane Health Management (AHM) system to monitor Jade Cargo's fleet of six 747-400 freighter airplanes.

AHM is a decision support system that uses real-time airplane data to provide fault forwarding, troubleshooting, and historical fix information to reduce schedule interruptions and enhance maintenance and operational efficiency by actionable information before, during, and after aircraft flights.



The AHM system, provided via the www.MyBoeingFleet.com portal, integrates the remote collection, monitoring, and analysis of airplane data to determine the status of an airplane's current and future serviceability or performance. It converts the data into information to help air carriers make fix-or-fly decisions.

The system sends alerts and notifications to airline personnel through the Internet, fax, personal digital assistants, e-mail, and pager services. "I believe AHM can extremely improve efficiency and reliability in our flight operation," says Captain Kay Kratky, Jade Cargo International's chief executive officer.

Jade Cargo International was founded by Shenzhen Airlines Company Limited, Lufthansa Cargo AG and DEG – Deutsche Investitions – und Entwicklungsgesellschaft GmbH, a subsidiary of KfW-Bank Group.

For additional information, visit Boeing at www.boeing.com, or Jade Cargo at www.jadecargo.com.

EMBEDDED COMPUTING

Mercury Computer Systems to deliver OpenVPX upgrade for airfighter radar defense application

Mercury Computer Systems Inc., an ISR subsystem provider, will deliver 6U OpenVPX computing modules and serial RapidIO IP (intellectual property) for a radar system upgrade on a leading tactical aircraft platform. Mercury's Ensemble 6000 Series OpenVPX HCD6410 High Compute Density Module addresses the customer's application size, weight, and power (SWaP) requirements, while providing scalability and low-latency operation with Mercury's multi-plane architecture.

Available in both air- and conduction-cooled configurations, the HCD6410 combines eight high-performance Power Architecture processor cores with various I/O capabilities and the scalable serial RapidIO interconnect. The HCD6410 also features the MultiCore Plus software infrastructure, which allows ease of portability in an open software development environment.

Brian Hoerl, vice president of worldwide sales for Advanced Computing Solutions

at Mercury, says: "Mercury's OpenVPX HCD6410 modules and serial RapidIO IP cores will provide the highest density signal processing while simultaneously simplifying interoperability with custom function RapidIO-based OpenVPX boards." ●

CSP optical failure analysis test sockets for EMMI or optical sensors introduced by Aries

Aries Electronics in Bristol, Pa., is introducing a CSP test and measurement socket with a window that optically exposes 100 percent of the top of the device under test for failure analysis testing in emission microscopy or optical sensors applications. Traditionally, a hole in the socket lid only exposes a maximum of 85 percent of the top of the device under test surface. Available with or without filters for UV, infrared,



and full spectrum applications, the electro-optics test socket connectors are for laser failure microscopy testing using laser signal injection microscopy techniques. These failure techniques are efficient, non-invasive optical analysis tools used to detect and localize certain IC failures with maximum clarity and contrast. The techniques can be done from front or back. The optical test socket line can accommodate quartz crystal, sapphire, and clear plastic window and lens materials. The window on the standard socket uses an optical quartz V077 glass with a 98 percent transmission rate from less than 260 nanometers in the near UV through to more than 2,000 nanometers in the infrared. For more information, visit Aries online at www.arieselec.com.

NEW PRODUCTS

To submit new products for consideration, contact John Keller by e-mail at jkeller@pennwell.com

» DATA BUSES AND NETWORKING

6U CompactPCI 24-port Gigabit Ethernet switch for harsh-environment military and industrial applications introduced by GE

GE Intelligent Platforms in Charlottesville, Va., is introducing the NETernity CP921RC-30x 6U CompactPCI 24-port rugged Gigabit Ethernet switch for harsh-environment applications in military, industrial,



and telecommunications systems. The networking board is a managed Layer 2/3+ switch with support for IPv6 switching and routing. The CP921RC-30x is optionally available with two front-panel 10 Gigabit Ethernet ports and two Gigabit Ethernet ports capable of supporting SFP+ and SFP transceivers—copper or fiber—for configuration flexibility. These ports are invaluable for high external bandwidth traffic aggregation environments. PICMG 2.16- and RoHS-compliant, the CP921RC-30x Ethernet switch supports high-availability hot swap as well as IPMI v1.5 for availability, maintainability, and manageability. As well as supporting Layer-2/3+ switching, it can support Layer 4-7 switching. A variety of rear switch boards is available to provide rear I/O configuration flexibility. The CP921RC-30x is also available in an extended temperature variant for demanding military and industrial applications. The OpenWare software environment, designed specifically for the NETernity range of switches, provides a substantially improved user experience for application development and support. Additional functionality or customization can be simply incorporated within OpenWare according to customer requirements. The OpenWare switch

management environment provides a set of configuration and management functions, including VLANs, Quality of Service, Link Aggregation, SNMP, MSTP, Multicast, and so on; these can be implemented via a serial console, Telnet, or the Web. For more information, visit GE Intelligent Platforms online at www.ge-ip.com.

» EMBEDDED COMPUTING

Rugged MicroTCA embedded computing system for radar, sonar, and video processing introduced by Kontron

Kontron in Poway, Calif., is introducing the OM6090D and OM7090D MicroTCA embedded computer boxes for military, medical, mobile telephony, and public safety engineering. These rugged computer systems are for high-end AdvancedMC boards and have a 10-Gigabit Ethernet switched backplane. In their maximum



configuration, both systems can be fitted with as many as 36 Intel XEON embedded computing processor cores and 216 gigabytes of RAM. The modular 19-inch 6U MicroTCA platforms are redundant and designed in compliance with the MTCA.1 specification for applications with demands for robustness, availability, and performance. Typical end-point applications include network in a box or rural utilities service (RUS) for rural and remote communication systems supporting CDMA, GSM, 3G, and VoIP across HLR/HSS, RNC, and gateway applications. The Kontron platforms also are for rapidly deployable mobile networks, radar, sonar, and video data processing.

These applications will benefit from the densely packed computing power of hot-swappable AdvancedMC modules and board-to-board dual-star switching beyond 1 gigabit per second. For more information, visit Kontron online at www.kontron.com.

» CONNECTORS

Rugged connector from Amphenol provides power distribution for communications shelters, oil platforms

Amphenol Industrial in Sidney, N.Y., is introducing a rugged connector for power distribution as part of the company's line of NEPTUNE connectors for demanding power distribution applications like communications shelters, oil exploration, convention centers, manufacturing plants, and production platforms. The rugged connectors pair an aluminum housing with Amphenol's RADSOK contact technology to provide increased amperage and voltage in a compact, lightweight package. Amphenol's IP68-8-rated connectors, which have a dielectric strength of 1,800 volts, are available with plugs and receptacles from 30 amps through 400 amps at 600 volts. RADSOK uses an electrical terminal based on a hyperbolic grid configuration that enables lower insertion forces than standard contacts, while increasing available amperage and voltage. NEPTUNE's precision machined aluminum components are high-tensile-strength bar stock, finished with a hard coating to 40 points on the Rockwell C scale and are heat resistant to 750 degrees Fahrenheit. Operating temperature for the connector is -67 to 225 F. Armored and sheathed



cable built to IEEE-45/UL1309, IEC, BS, DIN, and JIC standards as well as unarmored cables and flexible cables, including S, SO, SOOW-A, W and G-GC, are compatible with the NEPTUNE line. Cable housings with ample wire space slip over the conductors after termination, eliminating cumbersome handling and seating of inserts with conductors attached. The nickel silver alloy plated contacts are interchangeable and reversible. Gold plating is available. The connectors are resistant to 60 Gs, exceeding Mil-STD-167-1 vibration standards. For more information, visit Amphenol Industrial online at www.amphenol-industrial.com.

» ENCLOSURES AND CHASSIS

Electronic enclosures for printed circuit boards that shield against electromagnetic interference introduced by Elma

Elma Electronic Inc in Fremont, Calif., is introducing an enhanced version of its Type 32 electronic enclosure with advanced EMI shielding. The Type 32 Enhanced has gasket spoons stamped into the aluminum along the frame to provide electromagnetic compatibility (EMC) shielding. The covers are folded in a rounded design that also helps contain electromagnetic interference (EMI). The design of the extrusions allows printed circuit board or other component mounting directly. The



Type 32 line of cases comes in 2U to 4U heights standard with various widths and depths. Customization is available. Other features include stylized rubber feet for desktop

applications, optional carry handles, and other accessories. The aesthetic bezel conceals the front assembly screws. For more information, visit Elma online at www.elma.com.

» INTEGRATED CIRCUITS

Fast A/D converters for software-defined radio, signals intelligence introduced by National Semiconductor

National Semiconductor Corp. in Santa Clara, Calif., is introducing the ADC12D1800 3.6 giga-sample-per-second analog-to-digital converter for software-defined radio, radar processing, signals intelligence (SIGINT), and electronic warfare applications. The A/D converter has dynamic performance of -147 dBm/Hz noise floor, 52 dB noise power ratio (NPR), and -61 dBFS intermodulation distortion (IMD) to enable a new generation of software-



defined radio architectures and applications, National officials say. In addition to the ADC12D1800, National introduced two other A/D converters: the ADC12D1600 with sampling speed as fast as 3.2 giga-samples per second and the ADC12D1000 with performance as fast as 2.0 giga-samples per second. All three PowerWise A/D converters are for software-defined radio and related applications like communications, multichannel set-top box (STB), and light detecting and ranging (LIDAR) applications. The A/D converter can help radio communications designers come up with new software-defined radio architectures due to the chip's ability to receive modulated, band-limited signals within a large bandwidth. In military radar systems,

one ADC12D1X00 combined with a digital down-converter can replace several mixers, filters, amplifiers, and local oscillator stages in traditional heterodyne double- or triple-conversion radio implementations. The latest class of software-defined radios requires the A/D converter to sample wide-bandwidth signals, so a new set of metrics, such as noise-floor, NPR, and IMD provide the best measure of a system's capability to extract narrowband information from a wideband spectrum, National officials say. For more information, visit National Semiconductor online at www.national.com.

» EMBEDDED COMPUTING

Rugged OpenVPX single-board computer for military embedded computing applications introduced by Extreme Engineering Solutions

Extreme Engineering Solutions Inc. (X-ES) in Middleton, Wis., is introducing the XPedite5470 high-performance 3U OpenVPX single-board computer with Freescale QorIQ P4080 processor for military embedded computing applications that require high performance in small form factors. The XPedite5470 computer board provides Freescale P4080 processor with eight Power Architecture e500 cores running at 1.5 GHz; 8 gigabytes DDR3-1333 ECC SDRAM in two channels; 256 megabytes NOR and 16 gigabytes NAND flash; hardware write-protection for NVRAM; Serial RapidIO, x4 PCI Express, and SerDes Gigabit Ethernet interconnects; and Ethernet and serial ports. X-ES officials say they are committed to deliver Freescale Semiconductor's QorIQ P4080 in five additional form



» NEW PRODUCTS

factors: 3U CompactPCI, PMC/XMC, VME, 6U VPX, and 6U CompactPCI. X-ES builds its P4080 products to scale from air-cooled commercial (0 to 55 degrees Celsius) to full conduction-cooled (-40 to 85 C) with shock and vibration testing. Linux, Wind River VxWorks, QNX Neutrino, and Green Hills INTEGRITY board support software packages are available. For more information, visit X-ES online at www.xes-inc.com.

» RF AND MICROWAVE

150-watt, solid-state amplifier introduced by AR Modular RF for wireless broadband network applications

AR Modular RF in Bothell, Wash., is introducing the 150-watt model KMS2010 solid-state power amplifier



module for wireless broadband network applications. The 52 dBm linear power amplifier operates from 1.75 to 1.85 GHz, has a scalable gain of 57 dB, and is designed to meet most communications protocols, including various types of OFDM. The module comprises a printed circuit board housed in a machine aluminum enclosure. The amplifier is protected from thermal overload, over-power, over-voltage, or wrong voltage polarity, as well as having an internal isolator.

For more information, visit AR Modular RF online at www.ar-worldwide.com.

» ENCLOSURES AND CHASSIS

Six-slot MicroTCA chassis introduced by Mercury

Mercury Computer Systems Inc. is introducing the Ensemble 2000 six-slot MicroTCA embedded computing chassis with switches built into the backplane to support Gigabit Ethernet (base interface) and a choice of communications fabrics, including RapidIO, 10 Gigabit Ethernet, and PCI Express. The backplane also includes a built-in system manager. The chassis supports mechanical stacking in a 19-inch rack, and the base interface, fabric interface, and clock can be daisy-chained across several chassis. For more information, visit Mercury online at www.mc.com.

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GO MILAERO BLOG

Green Lantern reads *Military & Aerospace Electronics*?

The movie buzz is heating up concerning *Green Lantern*, and the superhero movie scheduled for release next summer could have a connection to *Military & Aerospace Electronics*. I'm keeping my fingers crossed that we don't end up on the cutting room floor, but last March, at the movie producer's request, I sent off several print copies of *Military & Aerospace Electronics* for potential use in the upcoming *Green Lantern* movie, starring Ryan Reynolds.

Green Lantern is a test pilot who is granted a mystical green ring bestowing him with otherworldly powers, as well as membership in an intergalactic squadron tasked with keeping peace within the universe. It just so happens that he reads *Military & Aerospace Electronics*. That's what the producers told me, anyway. If we're lucky, moviegoers will see print copies of *Military & Aerospace Electronics* lying around the test pilot's ready room. I'm hoping those copies make it into the move.

more  <http://www.militaryaerospace.com/index/blogs>

DEFENSE EXECUTIVE

Night-vision image intensifier tubes re-invented


The pursuit of network-centric warfare on the digital battlefield is fueling attempts to re-invent the analog image intensifier tube common to night-vision goggles (NVG) and other kinds of night-fighting equipment to enable this low-light sensor to produce digital imagery that can be shared over tactical networks and viewed on digital displays. The analog image intensifier tube is a staple of more than half a million existing night-vision sensors, such as the AN/PVS-14 night-vision monocular. Although these devices remain valuable for night vision in military and law-enforcement applications, the images they produce are not much use to anyone beyond the person looking into the night-vision device.

more  <http://bit.ly/cabEXK>

AVIONICS INTELLIGENCE

Taranis combat UAV unveiled

The United Kingdom Ministry of Defence released its prototype unmanned combat aerial vehicle (UCAV): Taranis. The concept demonstrator will test the possibility of developing the first ever autonomous stealthy UCAV that would ultimately be capable of precisely striking targets at long range, even in another continent. The industry team behind Taranis includes BAE Systems, Rolls Royce, QinetiQ, and GE Aviation. United Kingdom officials will use the Taranis prototype to provide knowledge on the technical and manufacturing challenges and the potential capabilities of UCAS aircraft.

more  <http://bit.ly/cGQMFw>



GO COMMAND POST COMMUNITY

Space gallery vying for retired shuttle

Seattle's Museum of Flight broke ground on the first phase of its new \$12 million, 15,500-square-foot "Human Space Flight Gallery." The state-of-the-art gallery is a precondition to being awarded one of the retiring United States Space Shuttles, which may be delivered on the back of a Boeing 747 as early as July 2011. While a decision has not yet been made on where these last Shuttles will retire, hav-

ing a climate-controlled building in place for the Space Shuttle is among the requirements that NASA established in its 2008 and 2009 Requests for Information (RFIs) to the public.

"The Shuttle is among the rarest of space artifacts," says interim museum president and former president of Microsoft, Michael Hallman. "The possibility of securing one is very exciting, and... we believe we're uniquely qualified to be an outstanding caretaker for this incredible piece of American history."

more  <http://community.milaero.com>

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WIND RIVER

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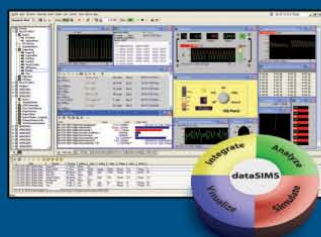
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